VOL. XVI. Nº 7 JULY 1931

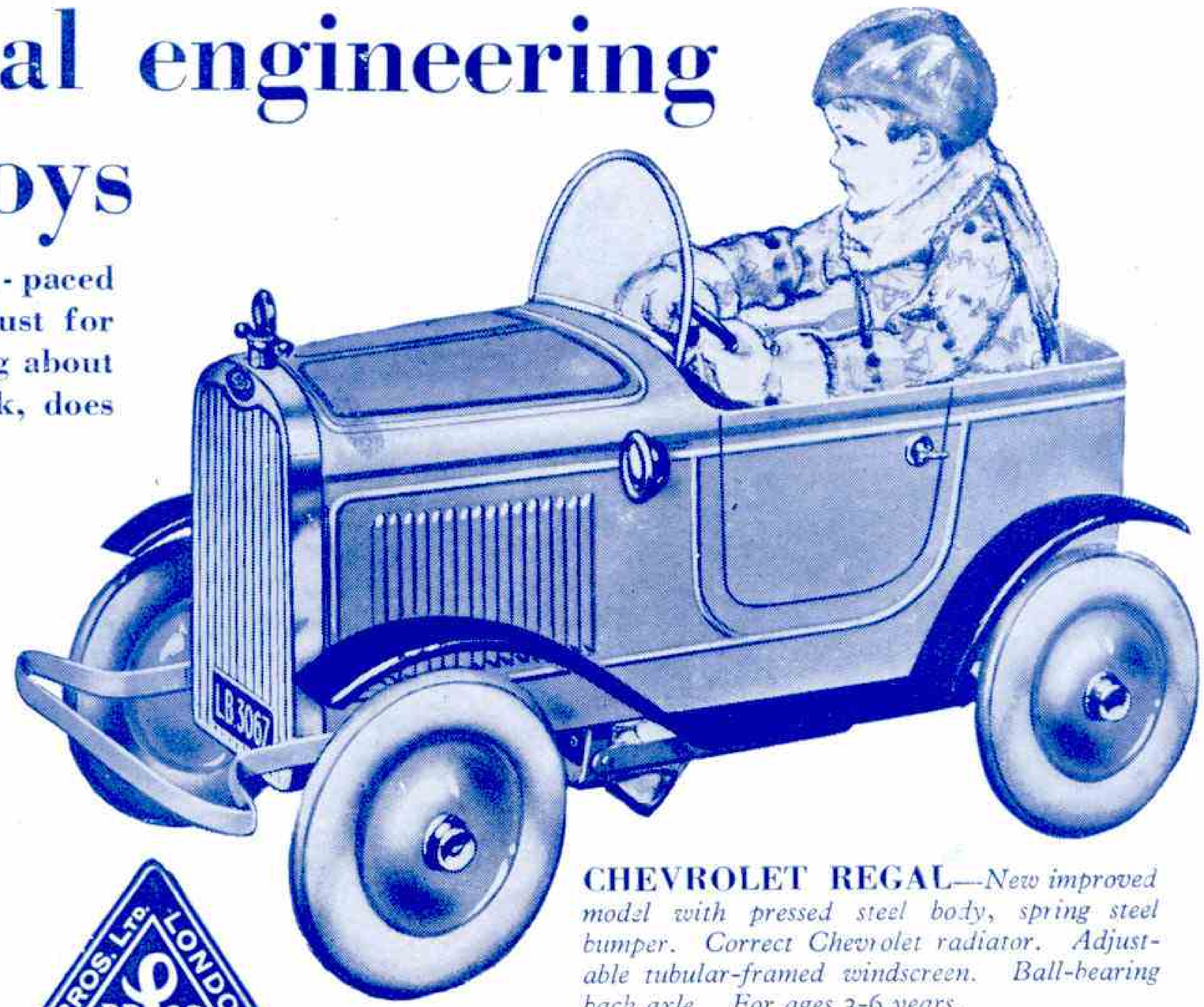
MECCANO MAGAZINE

THE "ENDURANCE" FAST IN THE ICE
(see page 530)

6D.

There's real engineering in these toys

Tri-ang Toys are thorough-paced engineering jobs. Made not just for show, but for work. Everything about them that can be made to work, does work. For their makers, Lines Bros. Limited, very well know that nothing less than that is enough for the stern young realists of the rising generation. Consider these cars, for instance. Pressed steel bodies, adjustable windscreens, ball-bearing back axles, half-elliptic springs—bonnets that open, lamps that light: isn't this the sort of thing the young idea talks in his sleep about? Get in touch with the Tri-ang agent and hear all about the whole Tri-ang range.



L. BROS. Ltd. LONDON BR OS ENGLAND
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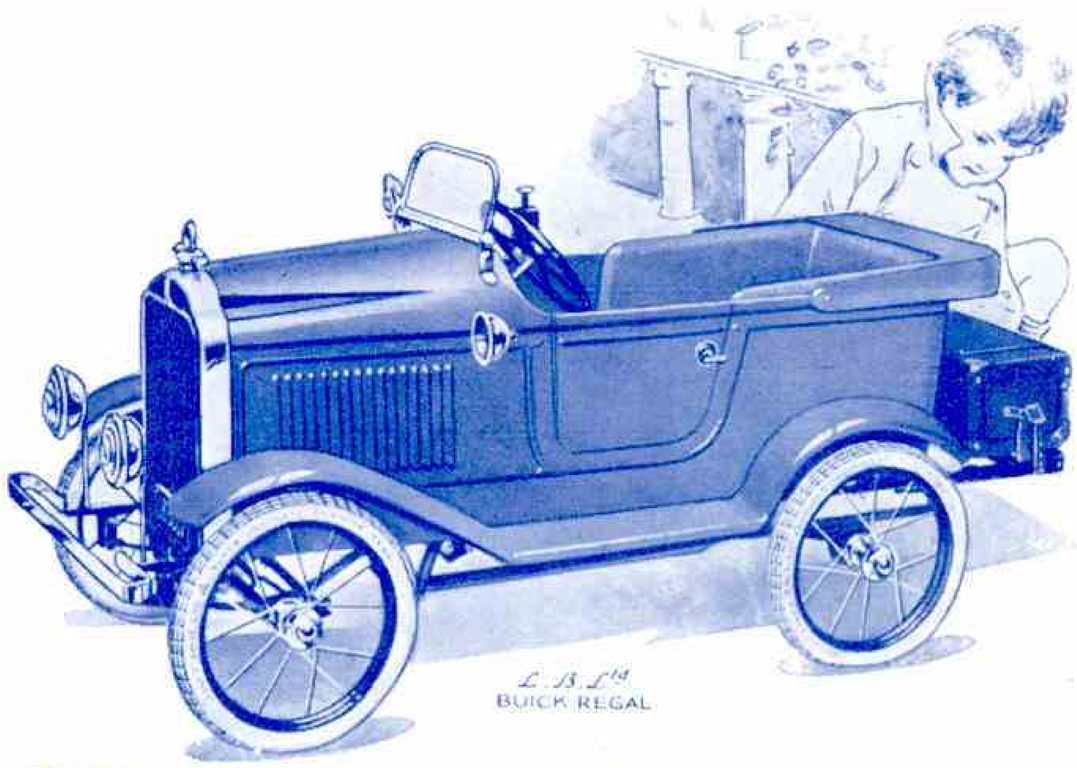
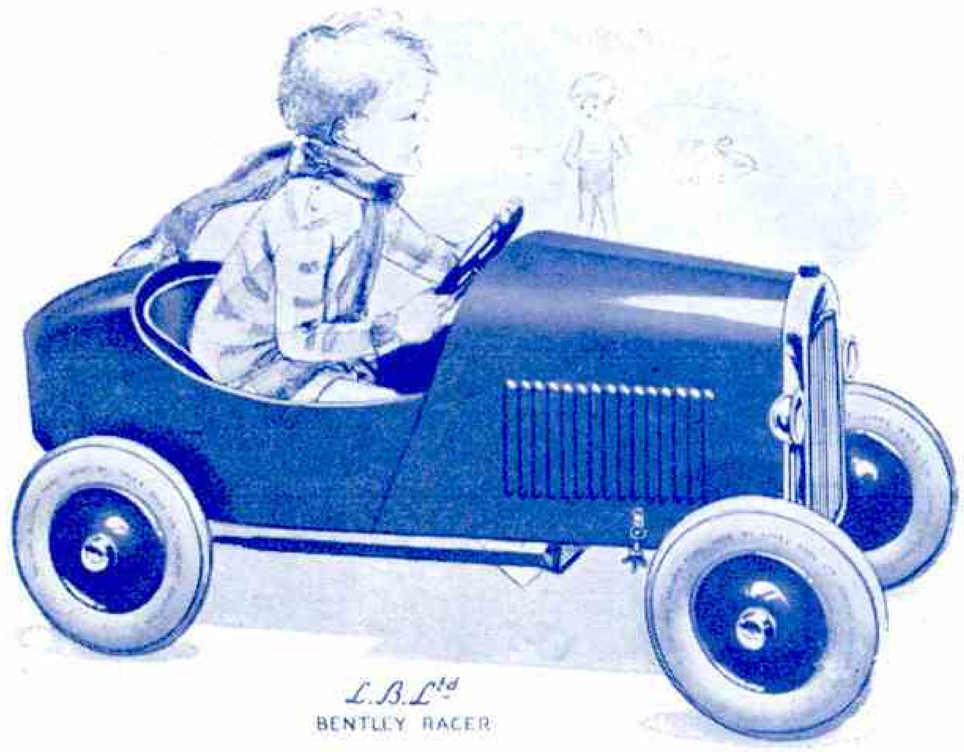
CHEVROLET REGAL—*New improved model with pressed steel body, spring steel bumper. Correct Chevrolet radiator. Adjustable tubular-framed windscreen. Ball-bearing back axle. For ages 3-6 years.*

CHEVROLET MAJOR *is longer. For ages 4-8 years.*



BUICK REGAL—*Pressed steel body on half-elliptic springs. Ball-bearing back axle. Adjustable tubular-framed windscreen. Fitted for two electric lights. 1 1/16 in. white auto tread tyres on tangent spoked wheels. Luggage grid and trunk. For ages 4-8 years.*



BENTLEY RACER—*All steel body, lift-up bonnet. Adjustable seat. Plated model Bentley radiator. 9 in. steel balloon wheels, ⅞ in. rubber tyres. Rubber pedals. For ages 3-6 years.*

BENTLEY RACER MAJOR *is longer. For ages 4-8 years. Ball-bearing back axle, 11 in. balloon wheels*

Lines Bros. make these all-metal toys—tip lorries, wagons, vans, breakdown lorries, airplanes, doll's prams, cranes, barrows, fairycycles, Tri-ang (regd.) cycles and tricycles, scooters, pedalkars, etc., etc.

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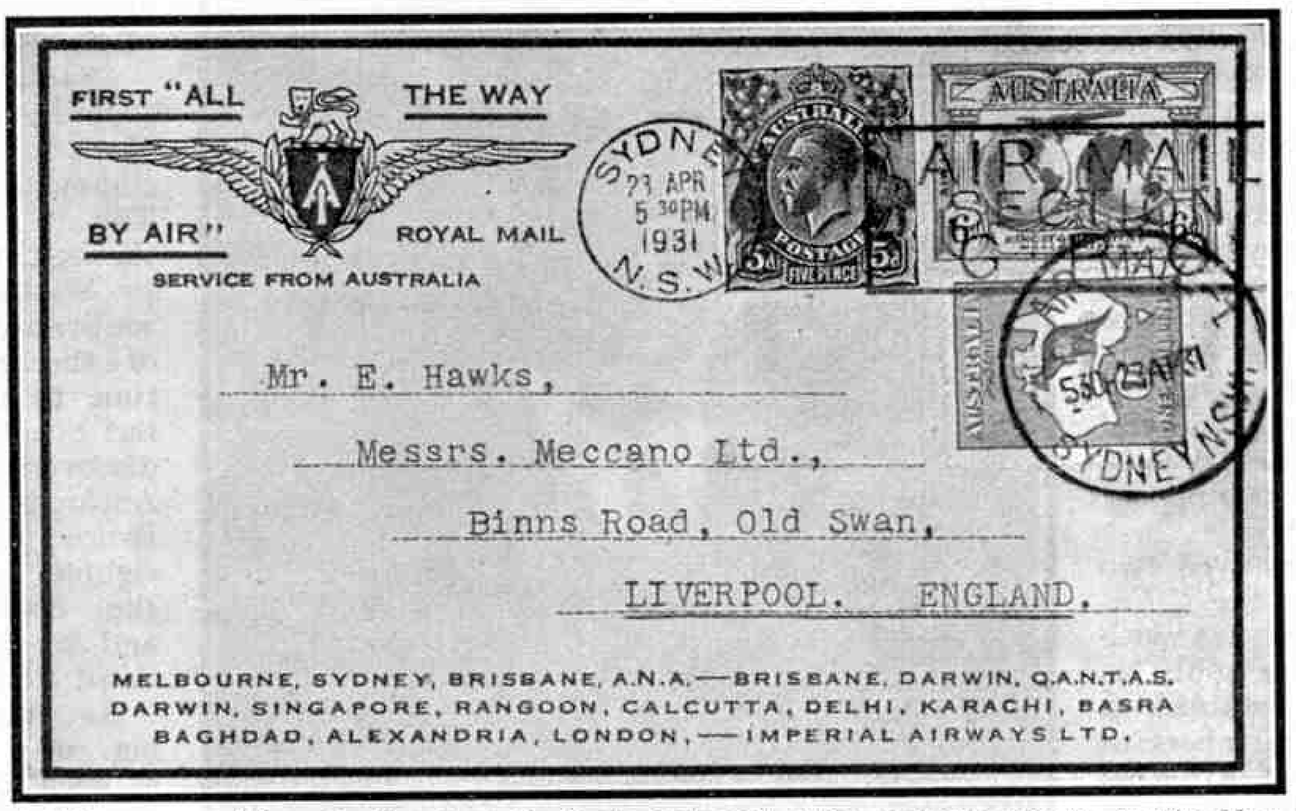
With the Editor

Empire Air Mail Services

Twelve years ago the first flight from England to Australia was made by the brothers Sir Ross and Sir Keith Smith. Since then the journey has been made on many occasions, and in April of this year the first air mail flight was carried out between the two countries. This flight was really an extension of the existing London-Karachi service, and the mails carried were scheduled to arrive at Port Darwin 15 days after leaving London. From Port Darwin they were to be flown to Sydney and Melbourne by the Australian "Qantas" Company. Unfortunately the Imperial Airways machine flying the India-Australia section of the journey was forced to descend on an island in the Dutch East Indies, and the mails were carried the remaining 500 miles to Port Darwin in an aeroplane piloted by Air Commodore Kingsford-Smith. The return flight was completed without incident, the distance of 13,500 miles from Sydney to London occupying 20 days.

I reproduce here a photograph of the "flown cover" of a letter sent to me by Mr. E. G. Page, our Australian agent. In his letter Mr. Page says "It is with great pleasure that I send you greetings by the first 'All The Way By Air' service to England. This surely marks a great event in the history of the present age, and I feel sure that you, and Meccano boys throughout the world, will be interested in the envelope in which this letter is enclosed. The successful establishment of such a service as this will, I feel, have the effect of bringing us in nearer touch with the Homeland, and prove most valuable to all those with business connections Overseas."



A "flown cover" from the first Australia-England air mail, which arrived in London on 14th May. The total number of letters carried was about 60,000. A special envelope was provided by Imperial Airways Ltd., and it is interesting to find that a large proportion of the letters bore the new 6d. stamp commemorating Air Commodore Kingsford-Smith's famous flights.

Empire communications have advanced enormously with the increase in the speed of transport. By means of air transport it is now possible to travel from London to Karachi in 5½ days, which is about 15½ days less than the time taken by fast mail steamer. The North African section of the London to Capetown air route has also made possible a great saving of time. For instance, Mwanza in Tanganyika Territory can be reached in nine days; when this journey is carried out by surface transport, even with the most favourable connections, at least 24 days are taken. Even these times could be reduced, for a light aeroplane has been flown to Australia in less than 10 days, and it was to demonstrate the slowness of existing services that the late Commander Glen Kidston made his 6½ days' flight to the Cape.

At present mails are conveyed in machines designed primarily for passenger carrying. Consideration for the passengers demands that these machines shall not remain in the air for too long at a stretch, and night flying is impracticable. If mails were carried in aeroplanes designed exclusively for the purpose, much higher speeds could be maintained. Regular night flying also could be organised, and this would considerably reduce the time required for their transport.

The "Dog Days"

We frequently read of the "dog days" of summer; I wonder how many of us know the origin of the term? To understand this we must go back many centuries, to the time of the Chaldeans, or even earlier. In those far-off times people were greatly interested in the stars, and studied them closely. They realised that the stars were far too numerous for each one to be distinguished by a special name, and therefore they divided them into groups or constellations, giving these names according to fancied resemblances in shape to men, animals and various objects. In most cases these resemblances are difficult to trace, but nevertheless the names of the constellations have persisted through the centuries and are still in use. The ancients believed firmly that the stars had an important influence on human affairs, and in their imaginative oriental manner they surrounded the constellations, and the brightest stars included in them, with a wonderful wealth of legend.

One of the best known constellations is that of Canis Major, or the Great Dog, in which the principal star is the brilliant Sirius. The ancients believed that the great heat of July was caused by the rising with the Sun of this constellation. The Romans called this period of the year the "dies caniculares," or dog days, and the phrase still survives. During these days human beings were believed to be subject to all kinds of evil influences, and dogs were supposed to go mad!

Centenary of the Dynamo

On 29th August, 1931, occurs the centenary of the discovery of the principle of the dynamo. This was due to Michael Faraday, the famous British scientist. For a few years before the discovery was made, it had been known that electricity could produce magnetism, and Faraday was convinced that in turn magnetism ought to be capable of producing electricity. After many failures he found that plunging a magnet into the interior of a coil of wire induced a momentary current, and that a current also flowed through the coil, but in the opposite direction, on taking the magnet out again. The dynamo and the electric motor were eventually developed from the crude apparatus he employed in these experiments, which therefore form the foundation on which the world-wide electrical engineering industry of to-day has been built.

Faraday's own career was an even greater romance than the growth of the electrical industry. He was born in Newington Butts, then a suburb of London, and became first an errand boy and then a bookbinder. His interest in science was aroused by reading books sent to him to be bound, and the wonderful story of how he became one of the world's most famous scientists will be told in articles that will appear in our issues for August and September.

EXPLORING THE ANTARCTIC

Famous Attempts to reach the South Pole.

V.—THE LOSS OF THE "*ENDURANCE*"

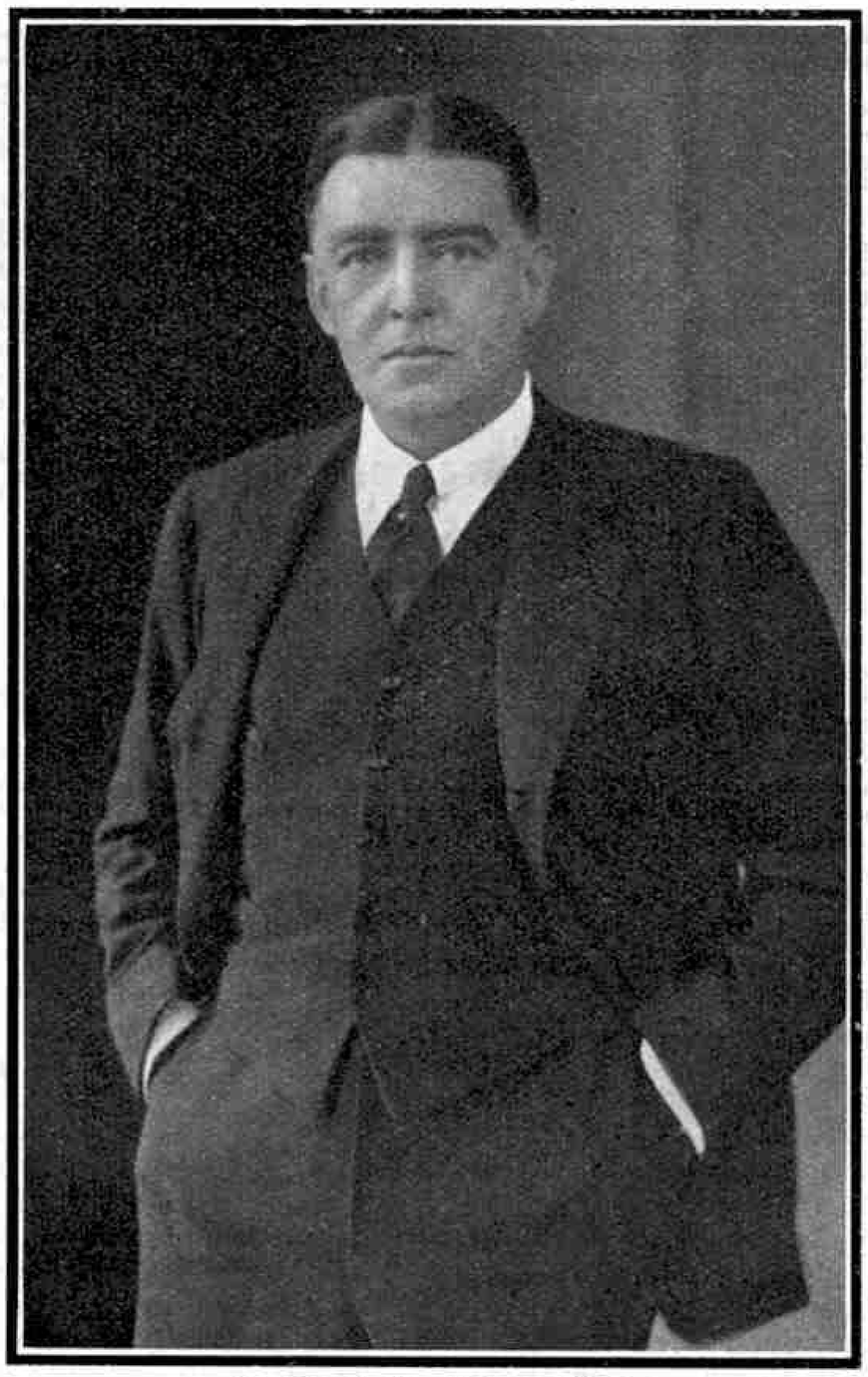
LAST month we told the story of Shackleton's great effort to reach the South Pole, a brilliant exploit in which he only failed by 97 miles to reach his goal. In the years that followed the explorer's return from the Antarctic, his former commander, Captain R. F. Scott, R.N., organised a second expedition. How Scott followed the trail blazed by Shackleton and reached the Pole on 17th January 1912, has already been told in this series. The Norwegian explorer Amundsen had arrived at the Pole on 16th December 1911, a few weeks before Scott, and thus Shackleton was doubly forestalled in his ambition to be the first man to set foot there.

This set-back did not damp Shackleton's enthusiasm and adventurous spirit, however, and he determined to attempt an even greater feat than merely reaching the South Pole. This was to land on the Antarctic continent south of Cape Horn, and to march across the Pole to his old base on Ross Island. On this march he expected to cover a total distance of about 1,800 miles, nearly half of which would be over completely unknown ground.

Shackleton's plan really involved two expeditions. He himself in the "*Endurance*" sailed into Weddell Sea with the intention of getting as far south as possible before landing to establish a base for his journey. The members of the second expedition went to Ross Island, where they established their headquarters at Cape Evans in the hut built by Scott. Their task was to establish provision depots on Shackleton's line of march, in order to give him assistance in completing his journey. They were successful in making the necessary preparations, supplies of food being carried right up to the foot of the Beardmore Glacier. Unfortunately they encountered terrible weather conditions. One member of the party died on the Barrier; another became seriously ill with scurvy; and only by the most desperate efforts did the survivors reach their base. Even then their troubles did not end, for Captain Mackintosh, the leader, and one of his men were carried out to sea as the result of a rash attempt to cross McMurdo Sound on ice that had not become sufficiently firm.

Considerable difficulty was experienced afterwards in relieving the men who had landed on Ross Island. The "*Aurora,*" the vessel in which they sailed south, was imprisoned in heavy pack for many months, and her rudder was broken and her coal exhausted before she was set free. Further delay was caused by the necessity for repairs, and the seven survivors of the ten men of the shore party had been in the Antarctic for nearly two years before the "*Aurora*" returned to bring them away.

The chief interest of Shackleton's undertaking attaches to the "*Endurance*" expedition. The explorers' task was a very dangerous one, for the ice in Weddell Sea is a formidable obstacle. In 1823 Weddell himself reached a latitude of 74° 15′S, but the season in which he sailed must have been very favourable, for his record stood until 1912. In that year Lieutenant Filchner, a German explorer, discovered land on the southern shore of the sea many miles nearer the Pole than Weddell's farthest south. Filchner's vessel was then gripped in the ice and carried helplessly northward by the drift, to be set free again on reaching the open waters of the South Atlantic.



Sir Ernest Shackleton, O.B.E.

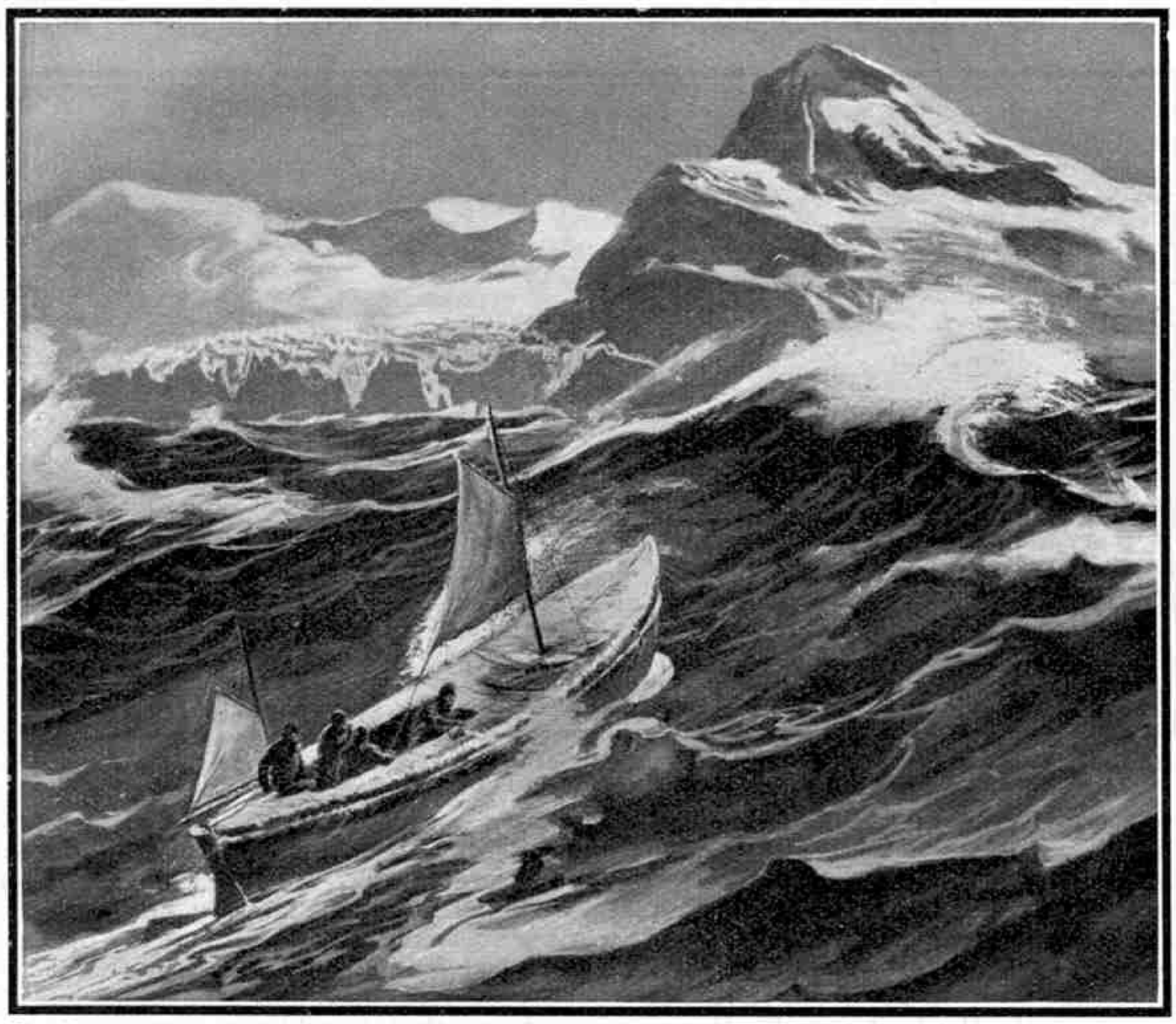
Shackleton hoped to land on the coast that Filchner had sighted, and there to establish a base from which to commence his march across the continent. The "*Endurance*" forced her way through the pack ice at the entrance to Weddell Sea, and steamed slowly southward along the eastern coast of the great ice-bound bay. From time to time she was held up by ice, but eventually she reached Coats Land, discovered in 1904 by the Scottish Antarctic Expedition under Dr. W. S. Bruce. Farther south new land was sighted, connecting Coats Land with the coast discovered by Filchner; and to this Shackleton gave the name Caird Coast.

As the "*Endurance*" slowly made her way southward Shackleton kept a keen lookout for a landing place. He saw one on the coast that he had discovered, but pushed on in the hope of finding another nearer the Pole. He was doomed to disappointment, however, for the ice began to close around the ship, and eventually she was firmly gripped and unable to move. Occasionally open water would appear in narrow lanes, and strenuous efforts were then made to work the "*Endurance*" into it; but the water quickly froze again, and in the end all hope of release before the following spring had to be abandoned.

Then began a slow and irregular drift northward while the ice pressed remorselessly on the ship and threatened to overwhelm her. During the anxious days that followed, Shackleton not only saw his chance of beginning a march across the Antarctic continent becoming more remote, but began to realise that the "*Endurance*" herself was doomed. Tremendous pressure piled thick blocks of ice against her, and she heeled over at a dangerous angle. She had been specially strengthened in order to enable her to cope with ice pressure, but nothing could withstand the power of the thick ice of the Weddell Sea, and her timbers began to give way. In preparation for emergencies, stores and equipment were transferred to the ice and three boats were lowered to the floe. Finally the men encamped on the ice a short distance away from the ship. This change was made

not a moment too soon, for the ice quickly closed over the "*Endurance*" and crushed her into matchwood.

The members of the expedition were now in a desperate plight, and they were fortunate in having such a leader as Shackleton, who was always at his best in difficult conditions. Rapidly he formed a plan to extricate the expedition from its perilous position, and by his prompt and energetic measures he inspired confidence in the scientists and seamen who constituted the crew of the lost vessel. He realised that a slow northward drift would gradually take the floes on which they were camped to the edge of the frozen Weddell Sea, where they would melt in the waters of the Southern Antarctic Ocean. He therefore decided to work his way westward, taking the precious boats with him, and to endeavour to land on one of the islands north of Graham Land on the west of Weddell Sea. There he hoped to find a depot that had been established for the benefit of shipwrecked sailors, and possibly also to meet one of the few whaling vessels that ventured so far south.



Shackleton and the crew of the "James Caird" approaching the glacier-fringed coast of South Georgia after a perilous voyage of 800 miles across the world's stormiest seas.

Unfortunately the ice was so terribly rough and broken that efforts to move westward proved unavailing, and for months Shackleton and his men drifted helplessly northward. As their floes approached the edge of the open sea, their position became extremely dangerous. The ice began to break up, cracks often opening suddenly and threatening to engulf men and equipment in the icy waters; and all had to be constantly on the watch for emergencies of this kind. Shackleton himself was continually on the alert. On one occasion a crack opened directly under his own tent, and he and the other occupants had a very narrow escape. Another time a member of the party fell into the water when a crack opened up beneath him. He was in his sleeping bag and therefore utterly helpless, and he certainly would have drowned but for the prompt action of Shackleton. As usual, the leader was on the spot immediately danger threatened, and he heaved man and bag on to the floe a couple of seconds before the crack closed up with a force that would have crushed the victim to death.

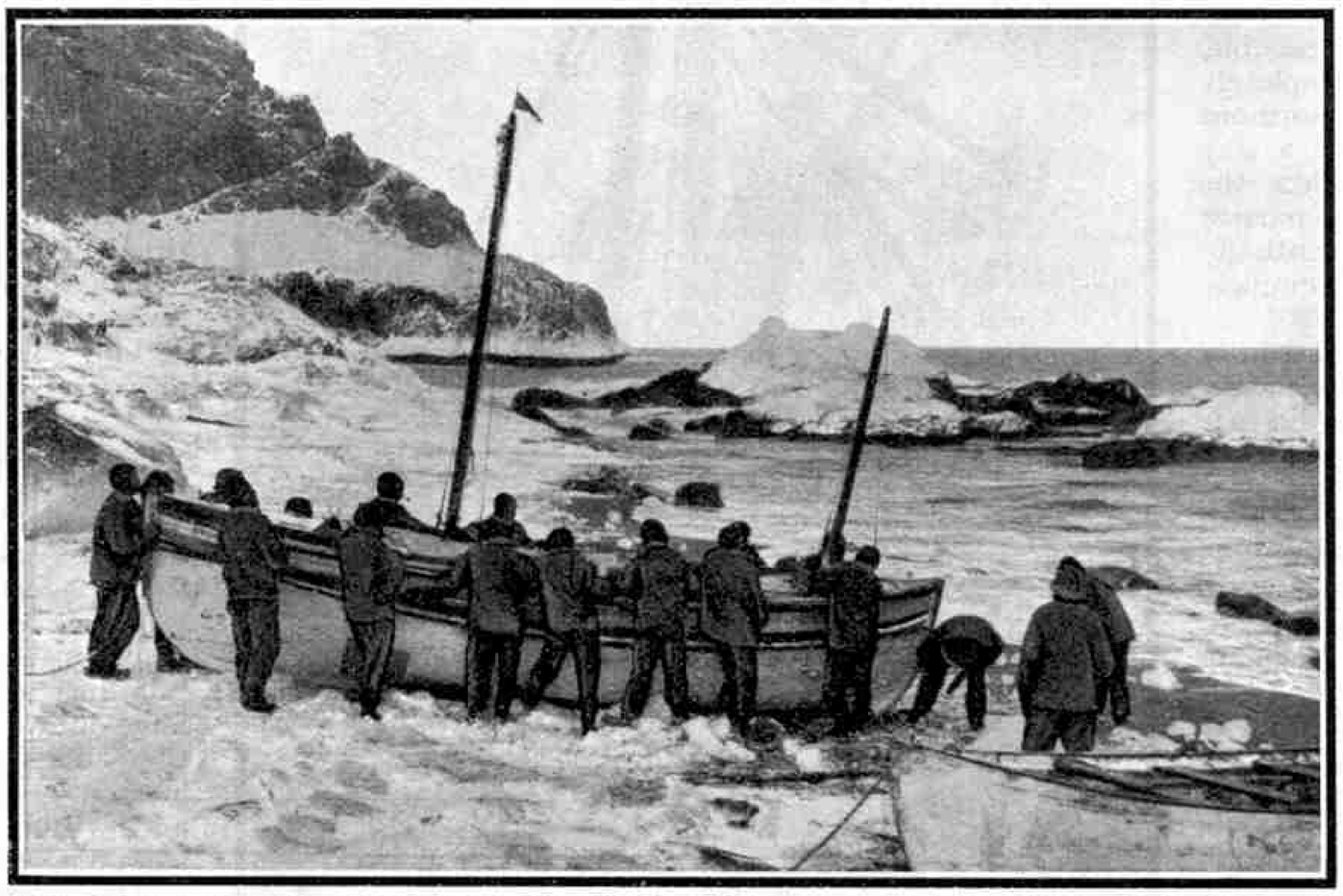
The drift of the ice carried the party past the land on which their hopes had been set. They could see mountains on the western horizon, but were utterly unable to reach them. The result was that when the ice broke up they were compelled to undertake a voyage in their open boats to Elephant Island, a bleak mass of ice and snow on which man had never previously set foot.

The last few days on the ice were spent in miserable conditions. At times the men were compelled to take to the boats, and at others it was necessary to return to the floe, dragging their boats up with them for safety. They were wet through with spray, which froze on the boats in quantities that threatened to overload and sink them. Food was scarce, particularly the hot food that is so absolutely necessary in Polar regions, and many of the men were frostbitten; but the energy and determination of Shackleton, aided by the cheerfulness of his officers, kept the party in good spirits.

Finally they were free from the ice. They hoisted sail and, in Shackleton's own words "moved over the waves like three Viking ships on the quest of a lost Atlantis," but their pleasure on being again afloat was quickly forgotten, for the wind freshened and the sea became very rough. All were weakened by their privations, but by hard work at the oars the boats were taken steadily northward.

The approach to Elephant Island was made after dark. Shackleton dared not venture ahead for fear of missing his objective and being driven out into the South Atlantic Ocean. A sea-anchor of oars was therefore made and the boats hove to. The three were roped together, and throughout the long night Shackleton himself sat in the stern of the "*James Caird*," the one at the head of the line, with his hand on the rope that connected it with the next in order to make sure that this did not come adrift during the night.

The night's delay was a terrible experience. The men were soaked, and those not on watch huddled up against each other for warmth. All were tormented by thirst, for they had been unable to reach ice to melt into drinking water. In the morning they saw their way clearly and drove through the water to effect a landing on the north side of the island. Shackleton decided that the landing—the first on this bleak shore—should be made by Blackborrow, the youngest member of the party. He was immediately helped over the side, but unfortunately his feet had become so severely frostbitten that he was unable to stand, and simply collapsed into the shoal water.



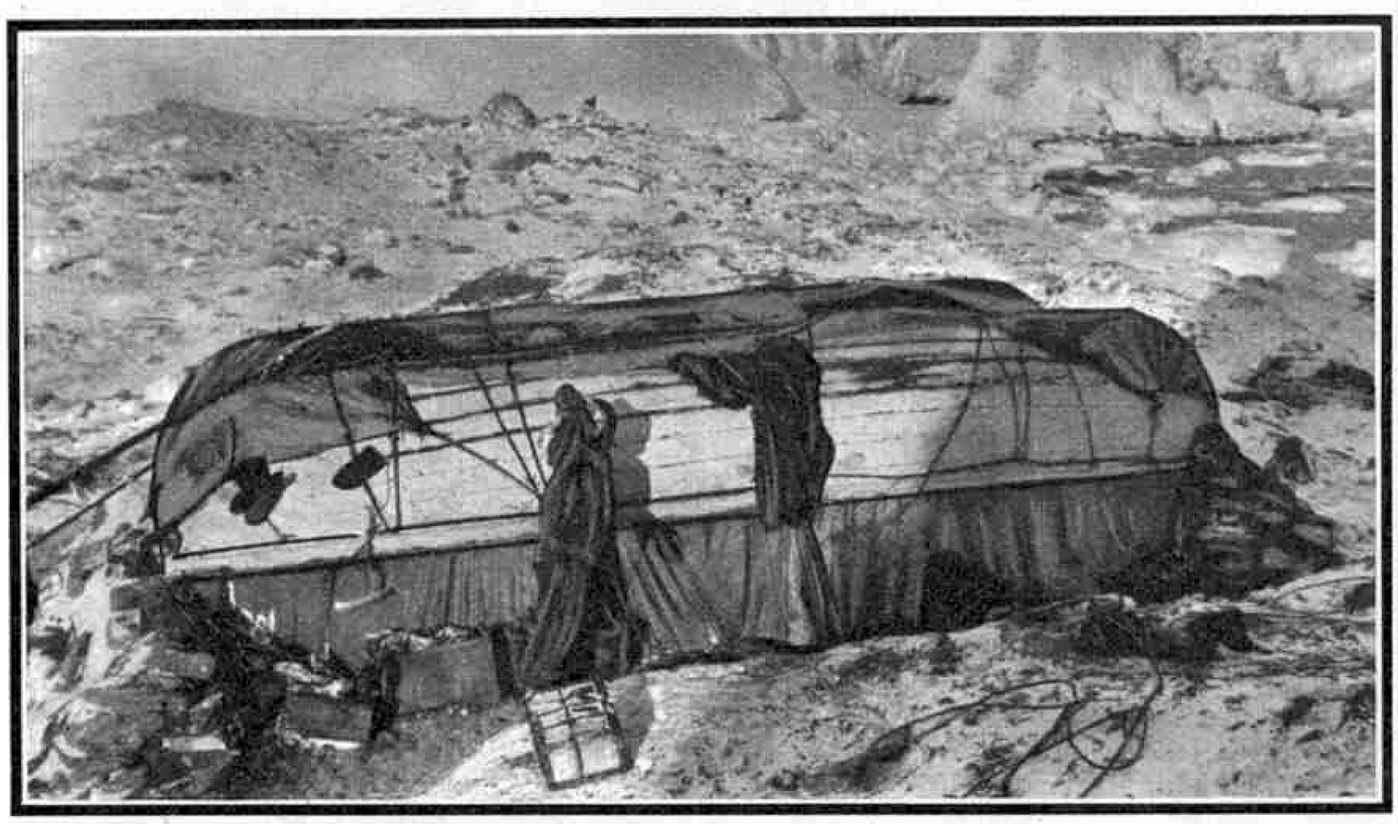
Making ready to launch the "James Caird." The lives of the men marooned on Elephant Island depended on Shackleton's ability to reach South Georgia in this tiny vessel.

Some of the men were almost delirious with delight on finding themselves again on solid ground. A blubber fire was soon set going, and a hot meal put new life into all. The task now remained of getting into touch with civilisation. The plan determined upon by Shackleton was to equip one of the boats for the 800-mile voyage to South Georgia, where there was a whaling station, and he decided to lead this forlorn hope himself. The rest of the party were to remain on Elephant Island with Frank Wild, the second in command, and one of the heroes of Shackleton's great march toward the Pole described in last month's issue.

The "*James Caird*," the boat in which Shackleton and a small

crew of five men were to set sail, was only 20 ft. in length, and was not in the best of condition after its long stay on the ice of the Weddell Sea. A kind of deck was built from sledge runners and lids of cases, and this was covered with canvas. The boat was then launched and the necessary stores and equipment were placed in her.

The voyage that followed must rank as one of the most daring and desperate ever undertaken. The portion of the ocean over which it was made is one of the stormiest in the world, and only by the most magnificent seamanship was the vessel kept afloat. Time after time enormous waves threatened to engulf her, and at least one member of the party was always at work baling her out. The hardships that the men endured are almost unbelievable. They were almost continually wet through, and the greatest difficulty was experienced in preparing hot meals with the aid of their Primus lamp. Sleep was nearly impossible, and it was a relief to be called upon for active duty. The steersman had a particularly unpleasant task, for the icy spray froze him to the marrow. On one occasion the man who was relieved of steering duty could not straighten himself, and had to be lifted into the centre of the boat and vigorously massaged before he thawed sufficiently to unbend his limbs.



The hut on Elephant Island in which the crew of the "Endurance" lived for four months. It was made by placing two boats upside down on walls built of rough stones.

Throughout the voyage the sun was scarcely seen, and only on one occasion was it possible to take a bearing. The practical seamanship of Shackleton and his companions brought them safely towards their destination, however, and at length they were overjoyed to see the ice-covered cliffs of the southern shore of South Georgia. The whaling stations were on the northern side of the island, and it was impossible to take the boat round. It was therefore run ashore in a bay, and camp was made in a small cave.

Shackleton and two companions, Worsley and Crean, then set off to cross the island in order to bring help, the remaining three men, two of whom were ill and worn out, remaining behind in the cave. Until that time the centre of South Georgia had been regarded as completely inaccessible. It was mountainous, and completely covered with deep snow and enormous glaciers. While searching for a way across the precipitous heights the three adventurers had many narrow escapes from disaster, but eventually they came within sight of Stromness, the chief whaling station.

Curiously enough, the last stage of the journey proved the most difficult, for it seemed impossible to find a safe way down the steep and icy slope of the mountain from which they saw Stromness. Eventually they set off down a channel cut by water. As they followed the stream downward, wet to the waist and cold and tired, they suddenly heard the splashing of a waterfall, which they found to be nearly 30 ft. in height. The only way down was through the water, for the steep ice cliffs on both sides of the stream were impassable. Fortunately they had a length of rope with them, and this was fastened to a heavy boulder and thrown over the brink of the fall. One by one the three slid down the rope, gasping for breath as the icy torrent washed over them. At the bottom they were on easy ground, and the whaling station was little more than a mile away.

Their arrival greatly alarmed the first people they saw. They were dirty and in rags, and generally had such a ruffianly appearance that two boys whom they asked for directions immediately ran away from them; while an old man who met them hurried away before they could speak to him. Eventually they succeeded in finding Mr. Sorlle, the manager of the station, whom they had met the year previously on the way south. At first he failed to recognise them, but when he realised who his unexpected visitors were he gave them a warm welcome.

Immediately the news of the desperate plight of the remaining members of the expedition became known, all were desirous to help. The first step was to bring in the three men stranded on the south shore of the island, and a vessel was immediately sent out for this purpose. Worsley accompanied her. He had a bath and a shave before setting out, and this so changed his appearance that the men did not recognise him at first, and grumbled loudly because none of their three companions in the epic voyage had taken the trouble to come to their help!

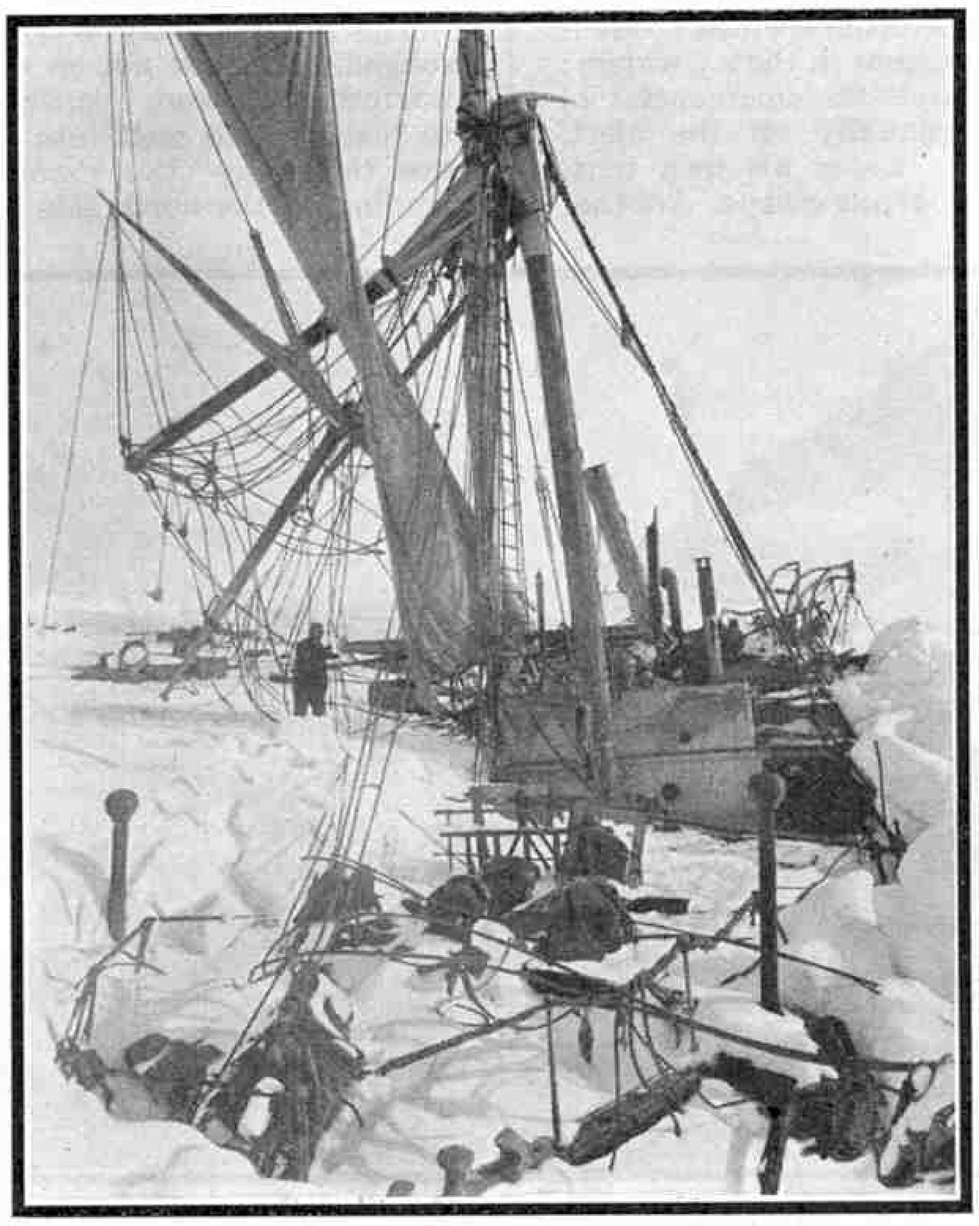
The rescue of the men on Elephant Island occupied an unexpectedly long period. Shackleton crossed to the Falkland Islands, and from there to Puntas Arenas in the Magellan Straits; and with generous aid from the governments of Uruguay and Chile he made several efforts in different vessels to reach the island. Time after time heavy pack ice drove him back, but a last and almost desperate effort in the Chilean Government vessel "*Yelcho*," a small steamship totally unsuitable for ice conditions, proved unexpectedly successful, and the men were brought off.

During their stay on the island Wild and his companions had had a very uncomfortable time, but throughout they had confidence that Shackleton would pull them through. Every day on which the sea was open Wild would say, "Get your things ready, boys, the Boss may come to-day." They lived on scanty rations, eked out by seal and penguin meat. Presently even this ran short, and they were compelled to fall back on limpets and seaweed boiled in sea water. When rescued they had only two days' supply of seal meat, and were stewing up again bones that they had thrown away a short time previously.

The party had been on Elephant Island four months when the mist lifted and revealed the "*Yelcho*" to one of the men who was outside the improvised hut. Wild was just serving out the soup, which he described as being particularly good that day—it consisted of boiled seal's backbone, limpets and seaweed!—when the men heard the shout of "Ship O!" In the rush for the narrow door the pot containing the wonderful soup was kicked over, but that did not matter, for their troubles were at an end. A boat put off from the ship, and soon Shackleton and Crean were with their old comrades. No time was lost in getting the men on board, and within an hour the vessel was steaming northward.

After their amazing adventures in the Antarctic Shackleton and his men returned to the civilised world to find the War in progress. Practically every man in the expedition almost immediately joined either the Army or the Navy, and Sir Ernest himself was deputed to carry out important work as a special British representative in South America. Later he was given the rank of Major

(*Continued on page 549*)



The "Endurance" in the grip of the ice, with members of the crew endeavouring to retrieve provision cases and valuable gear before she is finally overwhelmed.

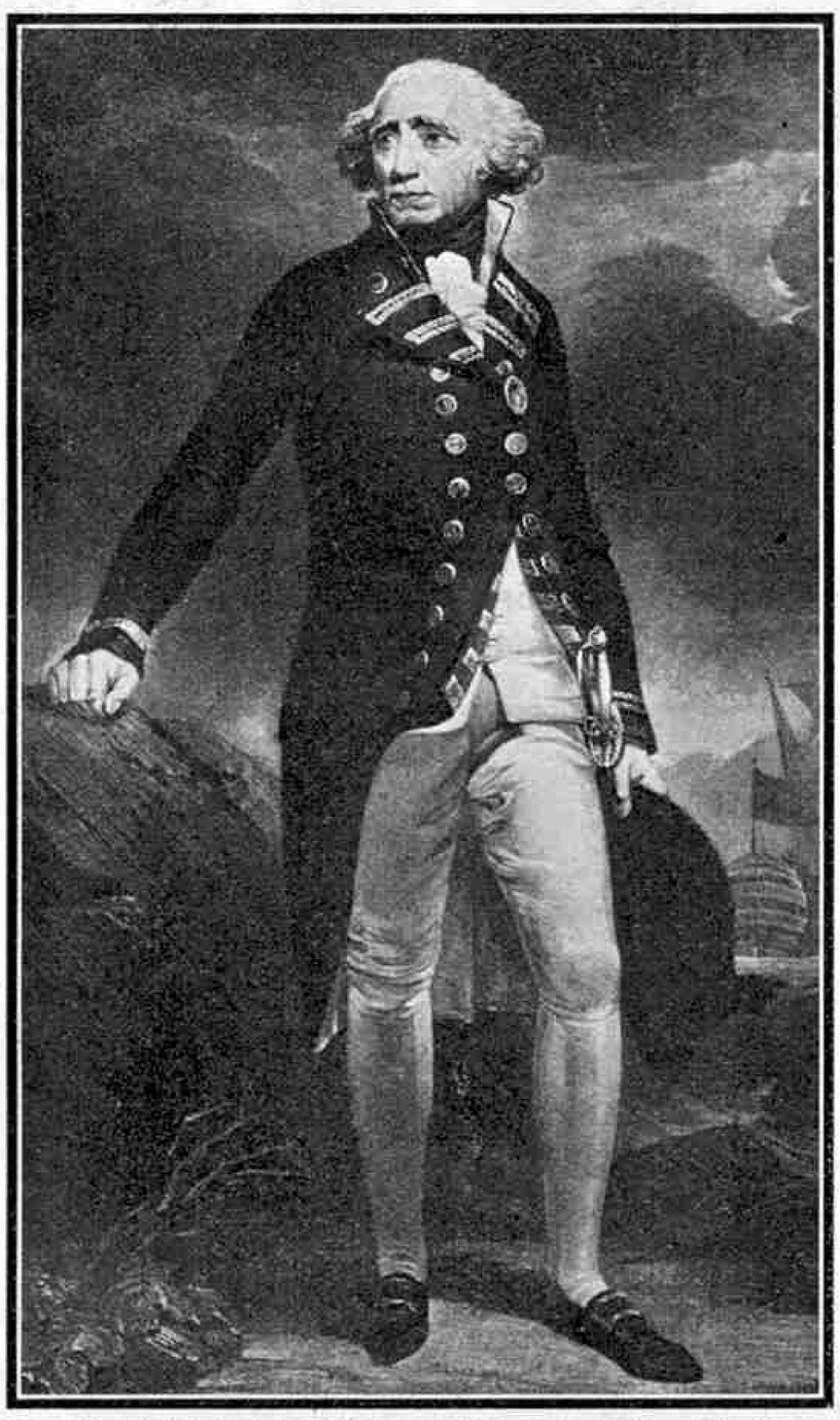
I.—LORD HOWE

IN last month's "With the Editor" a brief account was given of the great naval fight known as the battle of the "Glorious First of June," 1794, in which Admiral Lord Howe defeated the French fleet under Admiral Villaret-Joyeuse, off Ushant. Lord Howe is one of the outstanding figures in the thrilling story of the British Navy during the eighteenth century, and his career is therefore of great interest and importance.

Richard Howe was born in 1725, his father being the second Viscount Howe in the Irish peerage. After a brief spell at Eton he entered the Navy at the age of 14 as a midshipman on board the *"Severn,"* a vessel of 50 guns, which then formed part of a squadron under Captain George Anson, ordered to attack the American settlements of the Spaniards in the Pacific Ocean. This must have been a terrible experience for a young boy on his first voyage. In his book *"The British Navy,"* Mr. Ernest Protheroe says of this expedition: "The ships given to Anson for what was to prove an immortal voyage round the world were for the most part unseaworthy; and the crews were not only short-handed, but consisted largely of worn-out men, utterly unfit for the strenuous demands that would be made upon them. The expedition was to include a land force of 500 men, who were called up chiefly from among the out-pensioners of Chelsea Hospital; few of them were less than 60 years of age, and all were long past service in a marching regiment. Half of the men selected failed to put in an appearance, and really they did Anson good service by hiding themselves until after the vessels had sailed. Some of those who went aboard never came up on deck from below until they were carried up dead to be committed to the sea.

"The squadron sailed on 18th September 1740, and from the commencement of the voyage sickness attacked the crews, necessitating the landing of some of them on St. Catherine's Island. In the neighbourhood of Cape Horn gales played havoc with sails and rigging. Next the crews suffered from scurvy, and in a period of only four weeks the flagship alone lost nearly 50 men. In the course of a particularly bad spell of weather the vessels got separated, and the *"Severn"* and the *"Pearl"* returned to England." We hope to give a description of this remarkable voyage later, when we come to deal with the career of Admiral Lord George Anson.

We know little or nothing of Howe's doings during this expedition, but he does not seem to have been in the least dismayed by the experience. He evidently acquitted himself well, for he gained the approval of his commander and was promoted to lieutenant.



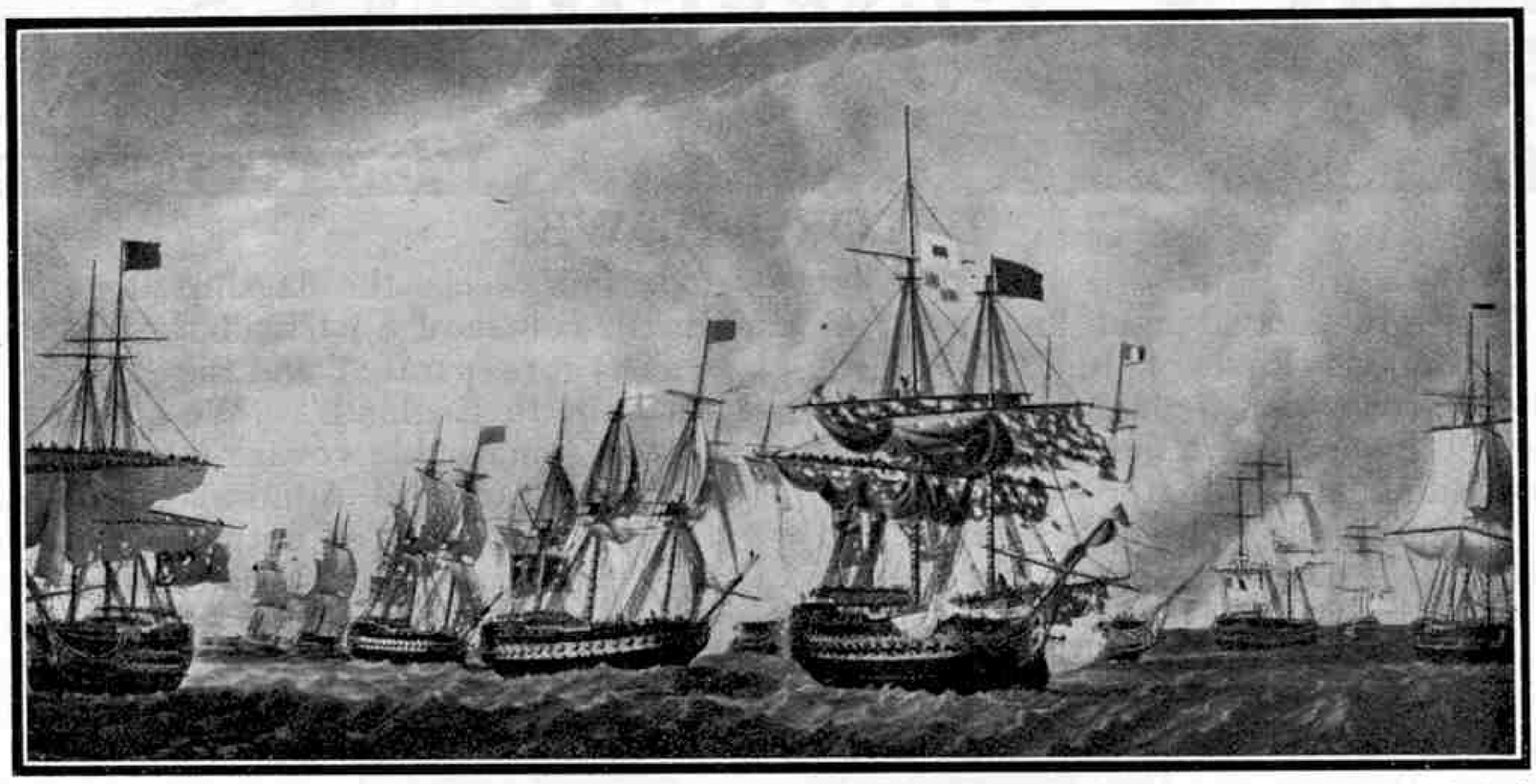
Portrait of Admiral Earl Howe published in 1799. The illustrations to this article are from prints in the possession of T. H. Parker Ltd., 28, Berkeley Square, London, W.1., by whose courtesy we are enabled to reproduce them.

Shortly afterwards the youth was appointed to the command of the sloop *"Baltimore,"* and in this vessel he had his first real opportunity of showing his courage and his ability as an officer. During a cruise off the coast of Scotland, in company with the frigate *"Greyhound,"* he fell in with two French frigates crowded with troops and munitions for the Pretender. Howe immediately ran the *"Baltimore"* between them, and a desperate action commenced. In the fighting Howe was severely wounded in the head by a musket ball and was carried below, apparently dead. He quickly recovered however, and scarcely had the painful operation of dressing his wound been completed when he rushed back to his post, to be received with shouts of joy from his men. The action resulted in the French ships sheering off, the *"Baltimore"* being too badly damaged to pursue them.

In the capacity of post-captain Howe served on the Guinea coast and on the Jamaica station, returning to England in 1748. He devoted the next three years to the study of naval tactics, and after a short period of service on the coast of Africa he was appointed in 1752 to the *"Dolphin"* frigate and employed in protecting British trade in the neighbourhood of Gibraltar, and in other services, all of which he carried out with conspicuous success.

In 1755 he obtained the command of the *"Dunkirk"* of 60 guns, one of the ships commissioned in view of the expected rupture with France. The British Government

received information that a powerful French fleet destined for America was being prepared in the ports of Rochefort and Brest, and immediately ordered a squadron to be equipped. The French fleet set sail in the meantime, and Admiral Boscawen sailed in pursuit, but a series of fogs allowed the main body of the enemy to escape. Howe fell in with the "*Alcide*," however, and after a short and sharp action captured the vessel.



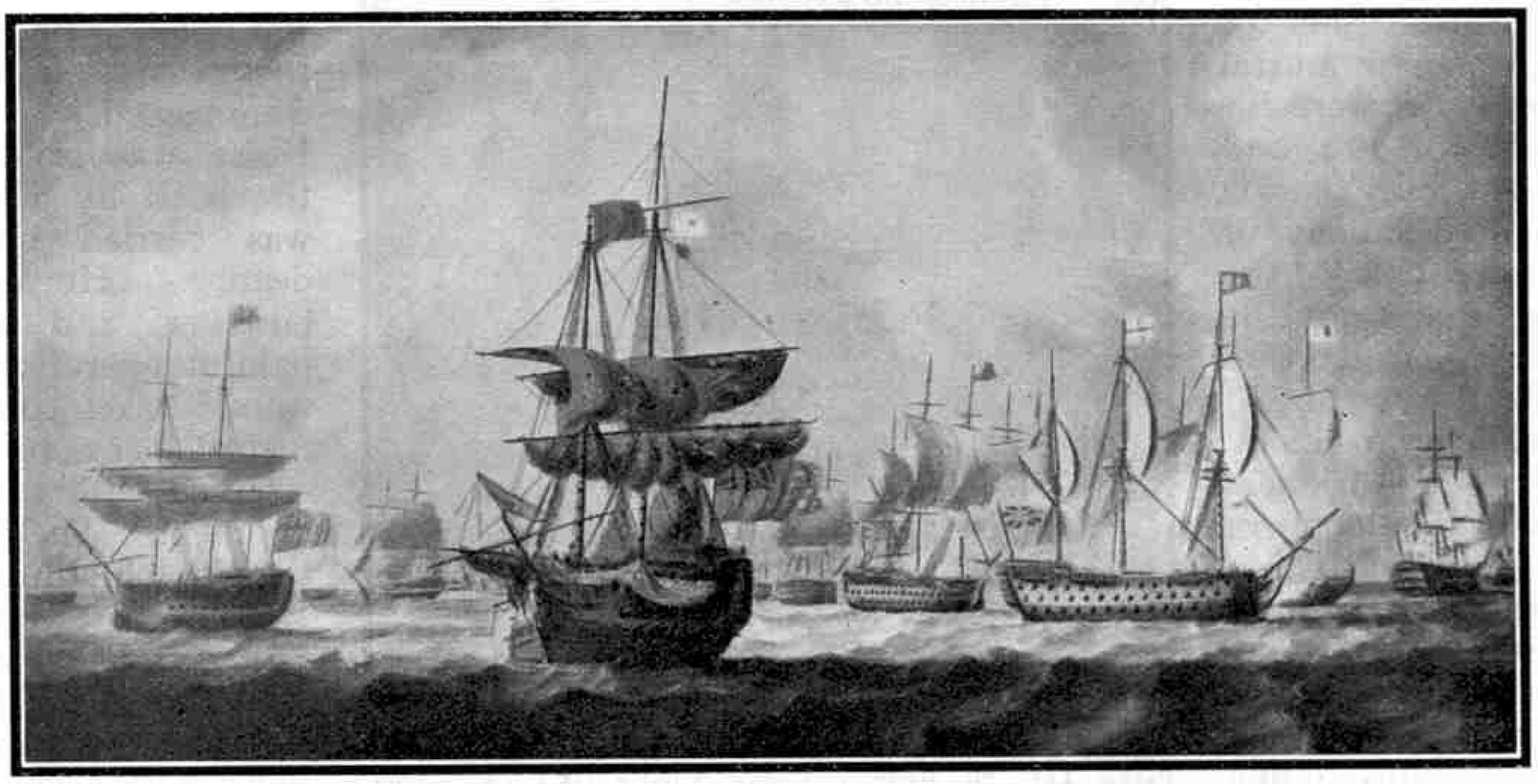
The commencement of the battle of the "Glorious First of June," 1794. It shows the British ships gaining the wind of the enemy's fleet.

A curious account of this fight is given in Campbell's "*Lives of the British Admirals.*" "Howe . . . . hailing the captain, delivered his orders that he should go immediately under the English admiral's stern. Hoquart quaintly asked 'whether it was peace or war'? Howe repeated his orders, and generously exclaimed, 'Prepare for the worst, as I expect every moment a signal from the flag ship to fire upon you, for not bringing to.' The ships being now close together, Howe had an opportunity of seeing the officers, soldiers and ladies who were assembled on deck. He on this took off his hat, and told them in French that, as he presumed they could have no personal concern in the contest, he begged they would leave the deck; adding that he only waited for their retiring to begin the action. Howe then, for the last time, demanded that the Frenchman should go under the English admiral's stern. Hoquart still refusing, was informed that the signal was out to engage . . . . . Orders to begin the action were given by both nearly at the same instant . . . . . every shot of the "*Dunkirk*" went through, all her guns being double shotted with round shot. In half-an-hour the "*Alcide*" struck to the "*Dunkirk,*" her inferior in rate, guns and men."

This action was really the beginning of the Seven Years' War, during which Howe did such splendid service that King George II complimented him by saying that his life had been one continuous series of services to his country. He captured the island of Chaussé from the French, distinguished himself in the fighting at St. Malo and Cherbourg, and in the fleet action against De Conflans he put out of action two enemy ships.

On the death of his brother he succeeded to the title of Lord Howe, and in 1763 was appointed to the Board of Admiralty, subsequently becoming Treasurer of the Navy. In 1770 he was promoted to rear-admiral of the blue. This statement perhaps needs a little explanation. There are three degrees of the rank of admiral, namely, admiral, vice-admiral and rear-admiral. Formerly each of these degrees consisted of three grades, distinguished respectively by red, white and blue flags, the red being the highest degree in each rank. The three degrees of red, white and blue flag officers were abolished in 1864, and the white ensign became the sole flag for ships of the Royal Navy proper.

In 1775 Howe was promoted rear-admiral of the white, and later in the same year he became vice-admiral of the blue and was given the command of the fleet to be despatched to America. Every enterprise in which this fleet was engaged was successful, but on account of its inadequate size little of real importance was accomplished. In 1782 he was advanced to the rank of admiral of the blue and given the command of the fleet destined for the relief of Gibraltar.

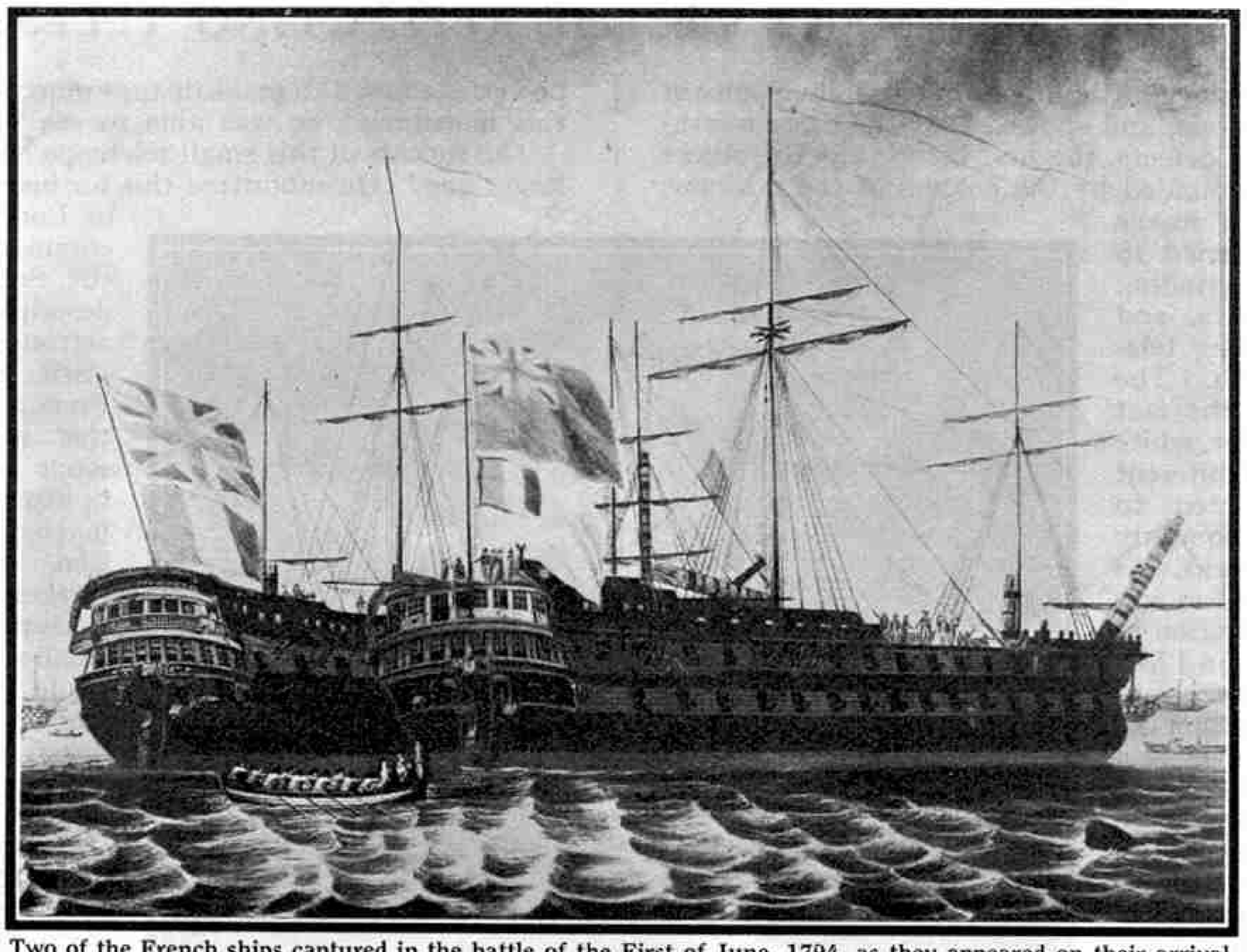


Lord Howe's flagship, the "Queen Charlotte," after the battle.

When Spain united with France against Britain in 1779, she was particularly anxious to regain Gibraltar, and a long siege began. The naval resources of Britain at this time were taxed to the utmost in coping with the combined French and Spanish fleets, and Gibraltar had to depend almost entirely upon its own resources. General Elliott was in command, and his courage, energy and resourcefulness completely baffled the Spanish and French attack. In September the allies made a final attack on an enormous scale by land and by sea, prepared for in advance with the utmost care. The onslaught was terrific, not less than 1,000 guns, many of them the

heaviest then in existence, being trained on the fortifications. Elliott replied by raining red-hot shot on the attacking vessels with such effect that before long most of them were set on fire, and either sank or blew up. The attack failed entirely, and the allies then settled down to starve out the garrison. Shortly afterwards Howe's fleet sailed for Gibraltar, and succeeded in relieving the garrison by landing troops and running a convoy of storeships into the bay. The allied fleet, which considerably outnumbered the British, declined to come to close quarters, but Howe engaged it at long range and forced it to retreat to Cadiz.

One of the most startling disasters in British naval history occurred while Lord Howe's fleet was being equipped at Spithead for the relief of Gibraltar. Among the splendid array of warships was the "*Royal George,*" one of the finest vessels of the 18th century. She was 143½ ft. long on the keel, nearly 52 ft. in beam and 21½ ft. in depth, and had a tonnage of 2,047. She had the highest masts of all English-built ships in the Navy, and carried 100 guns. A leak had developed in the ship, and in order that this should be repaired as quickly as possible orders were given that she should be careened, or heeled over, so that the defective place could be reached. Early on the morning of 29th August 1782, operations were commenced, and soon after ten o'clock she was heeled sufficiently for the purpose, and the carpenters and caulkers set to work. They had almost finished when a sudden squall struck the ship on her raised side and made her heel still more. Water poured in through the lower deck ports, which had been left open, and in a few minutes the great ship filled and sank in deep water. There were about 1,200 persons on board at the time, and of these nearly 1,000 were drowned, including Admiral Kempenfelt and all the other officers.



Two of the French ships captured in the battle of the First of June, 1794, as they appeared on their arrival in Portsmouth Harbour.

In 1783 Howe became First Lord of the Admiralty. Four years later he was promoted to admiral of the white and shortly afterwards was created an earl. On the commencement of the war with France in 1793 he was given the command of the Channel squadron, a post of the greatest responsibility. In order that his fleet should always be ready to engage the enemy, he initiated a system of short cruises so that his ships were never obliged to remain long in harbour to refit. On 1st June 1794, he won the great victory that was described last month. It is not necessary to repeat the details of this battle. The French fleet was a powerful one, and its admiral, Villaret-Joyeuse, was a man of the highest ability. On the other hand, although the greater part of the crew had had experience in American fighting, the conditions of the Revolution had to some extent undermined their discipline and efficiency. The strengths of the two fleets were about equal numerically, but the calibre of the French guns was the greater.

This battle is of particular interest in having been fought almost on the lines of Elizabethan days. We are told that Howe signalled "for each ship to steer for, and independently engage, the ship opposed to her in the enemy's line." He believed that ship for ship his efficiency was the greater, and the result proved that he was right.

A good idea of the nature of the battle may be gained from the following letter written by a midshipman in the "*Orion,*" and quoted by Mr. E. Keble Chatterton in his book "*Battles by Sea.*" "At eight the action began, and the firing from the enemy was very smart before we could engage the ship that came to our turn to engage, as every ship is to have one because our line is formed ahead, and theirs is also. Suppose their first or leading ship is a 100-guns and ours a 74, our ship must engage her. I believe we were the ninth or tenth ship; our lot fell to an 80-gun ship, so we would not waste our powder and shot by firing at other ships, though I am sorry to say they fired very smartly at us and unluckily killed two men before we fired a gun, which so exasperated our men that they kept singing out, 'For God's sake, brave captain, let us fire! Consider, sir, two poor souls are slaughtered already.' But Captain Duckworth would not let them fire till we came abreast of the ship we were to engage, when Captain Duckworth cried out, 'Fire, my boys, fire!' Upon which our enraged boys gave them such an extraordinary reception that I really believe it struck the rascals with the panic.

"The smoke was so thick that we could not at all times see the ships engaging ahead and astern. Our maintop-mast and mainyard being carried away by the enemy's shot, the Frenchmen gave three cheers, upon which our ship's company, to show they did not mind it, returned them the three cheers, and after that gave them a furious broadside . . . . At about ten the "*Queen*" broke their line again, and we gave three cheers at our quarters; and now we engaged whichever ship we could best."

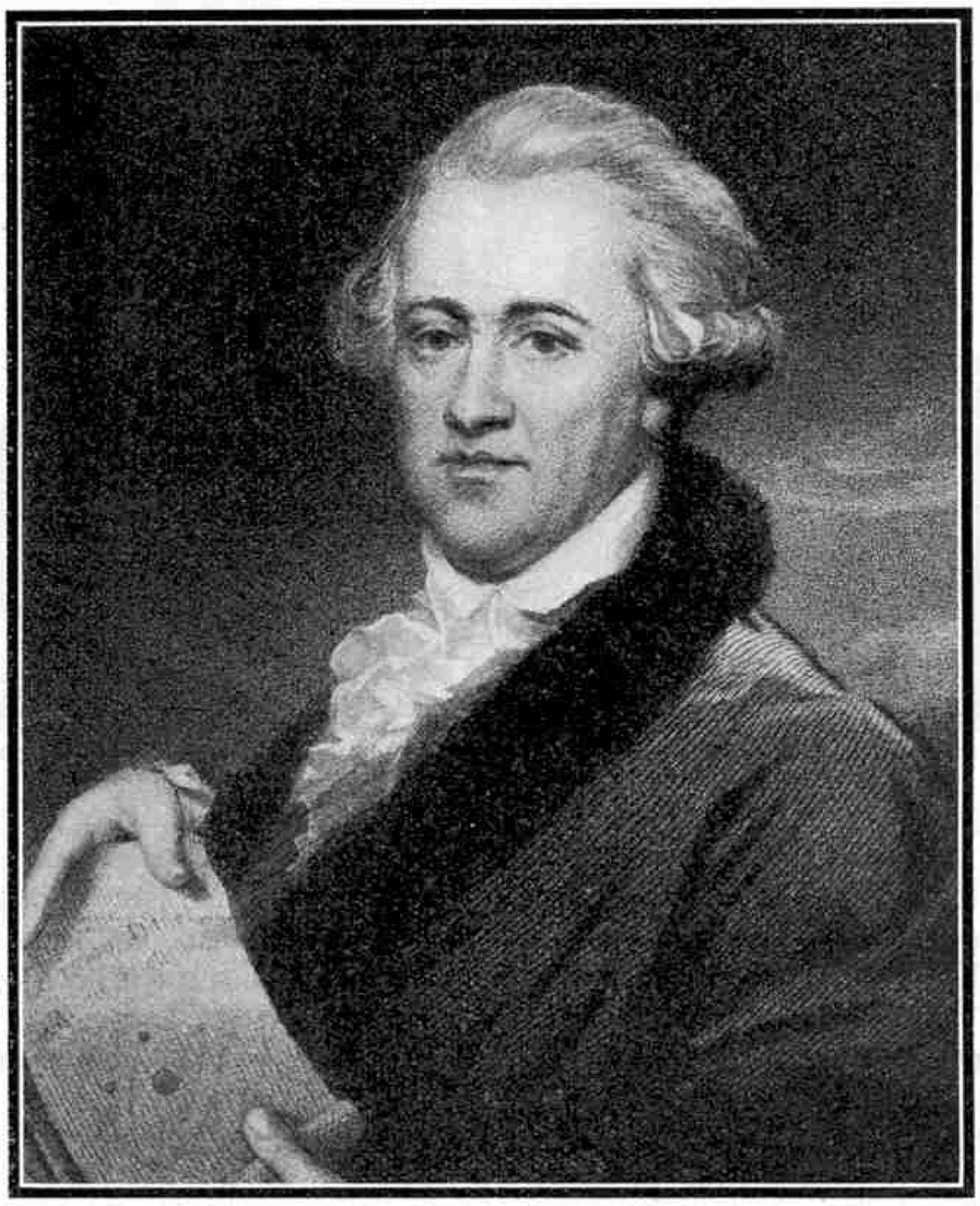
Howe has been blamed for not following up his victory, but in view of all the facts there is no doubt that his decision not to attempt to do so was wise. In his report Howe wrote: "In less than an hour after the close action commenced in the centre, the French admiral, engaged by the "*Queen Charlotte,*" crowded off, and was followed by most of the ships of his van in condition to carry sail after them, leaving us with about ten or twelve of his crippled or totally

(Continued on page 607)

XXIV.—DEVELOPMENT OF THE REFLECTING TELESCOPE

LAST month we told the story of the invention and development of the refracting telescope, and showed that the early instruments had two serious defects, the first being that the object viewed appeared to be surrounded by the colours of the rainbow, and the second that the image was distorted. Opticians tried to remedy these defects by grinding lenses of different curvature, and telescope makers by building telescopes of greater length. The trouble really arose from the fact that, as Newton showed later, white light is composed of rays of different colours, which are refracted to different degrees and consequently do not come to the same focus. As we saw last month, the problem was not solved until the introduction of the achromatic object-glass in 1732, and in the meantime many scientists had begun to doubt whether the refracting telescope would ever be a really efficient instrument.

In 1663 James Gregory, a Scottish astronomer, suggested a different type of telescope which, he claimed, would give a clear and undistorted image. His proposal was for a telescope without an object-glass, the tube being open at the mouth so that the light rays could pass direct to a large polished mirror at the other end. This mirror, which was to be of parabolic section, would reflect the light rays to a smaller and concave mirror suspended near the mouth of the tube, from which they would be reflected through a hole in the centre of the large mirror to the eyepiece. This instrument was thus a reflecting instead of a refracting telescope.



Sir William Herschel.

Gregory engaged an optician to construct a reflecting telescope to his design. The task of grinding a mirror or "speculum" of true parabolic figure proved too great, however, and a mirror of spherical form that was tried was not satisfactory. After many unsuccessful attempts to find an optician able to carry out his requirements, Gregory became discouraged, and finally he gave up hope of bringing his telescope into practical use.

In 1668 Isaac, afterwards Sir Isaac, Newton, produced a reflecting telescope similar in principle to that of Gregory, but differing in detail. Newton substituted for the small concave mirror a plane or flat mirror set at an angle of 45 degrees to the axis of the tube. This mirror reflected the rays from the speculum to an eyepiece at the side and near to the top of the tube. This arrangement dispensed with the need for the centre hole in the speculum that was a feature of Gregory's telescope. The first telescope made by Newton had a speculum only 1 in. in diameter, but it was powerful enough to make distant objects seem 39 times nearer. With this instrument he was able to see the satellites of Jupiter.

The success of this small telescope encouraged Newton to build a larger one. He submitted this for inspection by the Royal Society of London, and it was favourably commented upon at a meeting of the Society in January 1672. A description of it was sent to the astronomer Huygens, then living in Paris, and he passed it on to the French Academy of Science. In this manner the reflecting telescope became widely known on the Continent. Subsequently other matters claimed Newton's attention, and he did not continue further his study of the telescope.

During the following century small reflecting telescopes were made by various astronomers. Halley, who became famous by his discovery of the comet subsequently named after him, exhibited to the Royal Society in 1721 a telescope with a mirror 6 in. in diameter, and the splendid results obtained from this small instrument brought into prominence the comparative inefficiency of the huge refracting telescopes built by Huygens.

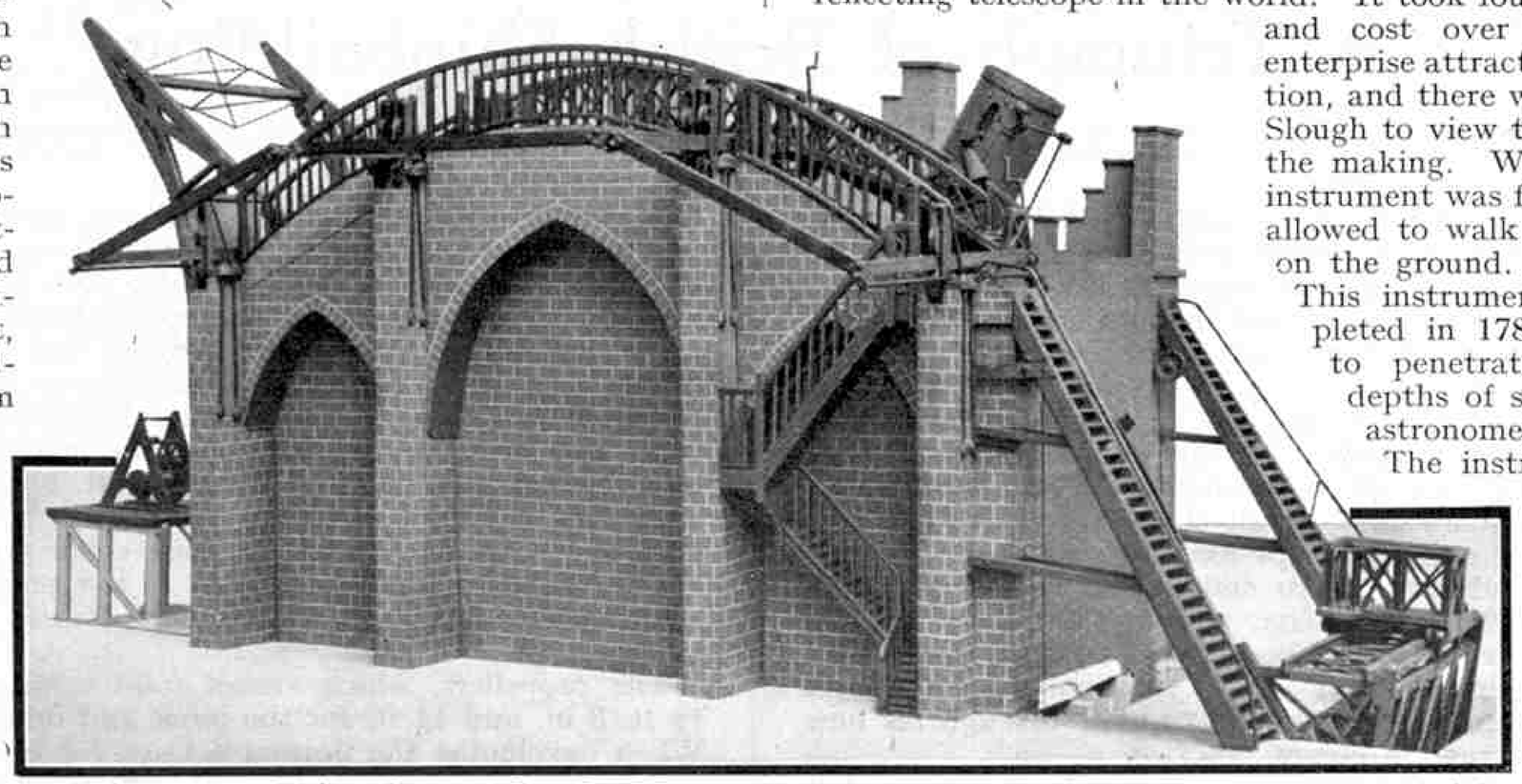
The next advance in the development of the reflecting telescope was the discovery by James Short in 1732 of a means of producing a speculum of true parabolic form. Short was born in Edinburgh in 1710 and was educated for the Church. He became interested in telescopes while still at the University, and he carried out experiments in telescope construction in his rooms. He favoured the reflecting type of instrument devised by Gregory but, like Gregory and others, he found it impossible to produce a parabolic mirror in glass. He therefore turned his attention to metal, and after much patient experiment he succeeded in making a metallic speculum of true parabolic form. Subsequently he took up telescope construction as a profession, and in 1742 he removed to London, where he was very successful. One of Short's last telescopes was a large instrument that was afterwards erected at the Edinburgh Observatory, and for which the King of Denmark is said to have offered 100 guineas.

Diagram of the principle of the reflecting telescope, reproduced from the Editor's book "The Romance and Reality of Astronomy," by courtesy of the publishers, Thos. Nelson & Sons Ltd.

A further development of the reflecting telescope was brought about by Sir William Herschel. This great astronomer was born at Hanover in 1738. His father, a bandsman in the Hanoverian Guards, taught him to play various musical instruments, and later he enlisted in the same band. When the French invaded Hanover, early in the Seven Years' War, the Hanoverian army was defeated

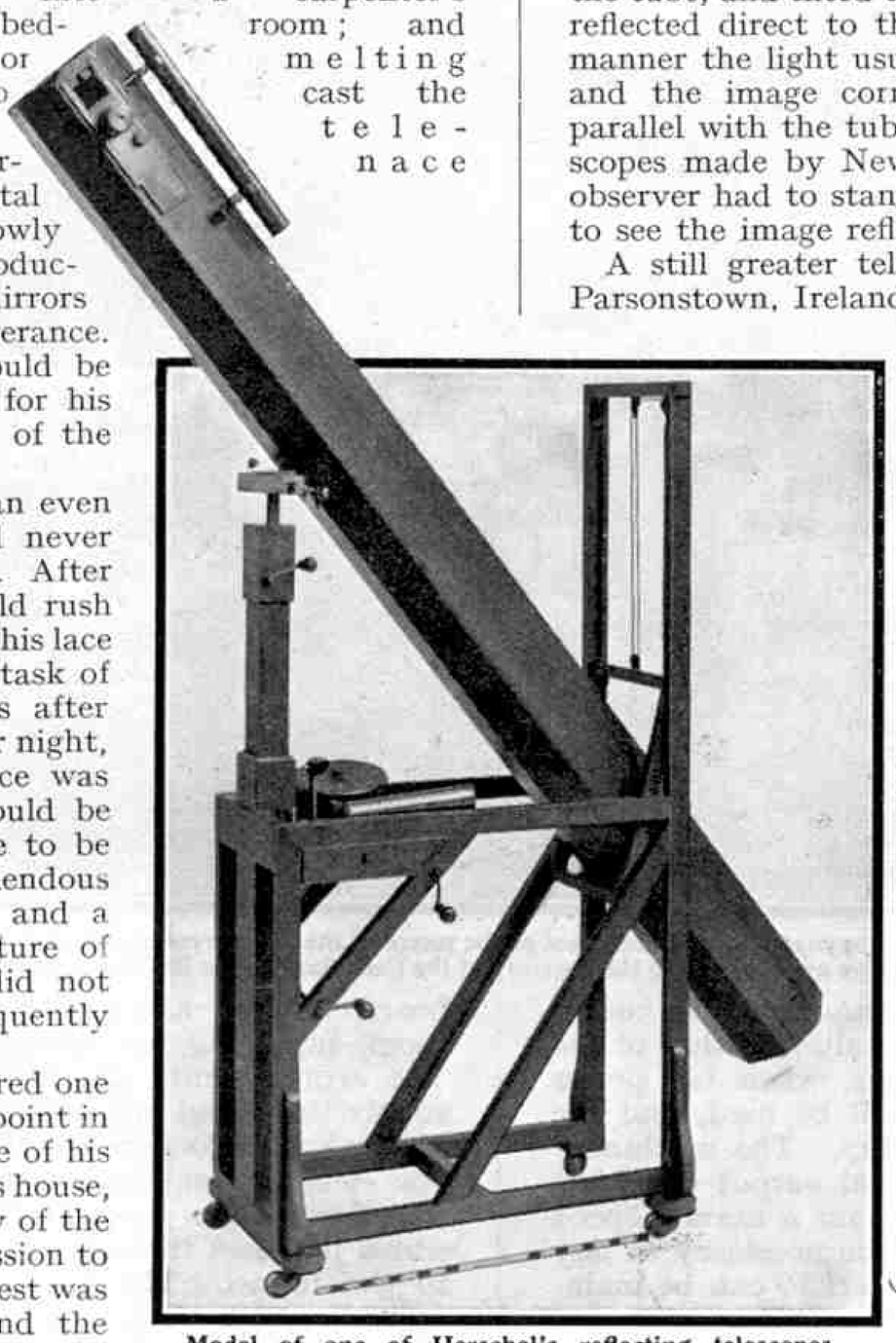
at the battle of Hastenbeck and had to surrender. Herschel managed to escape, however, and came to England. He set to work to make his living as a musician, and held appointments in various Yorkshire towns before he finally settled in Bath as conductor, organist and music teacher.

In order to improve his knowledge of the theory of music Herschel began to study mathematics, and through this study he became interested in astronomy, which soon absorbed his whole mind. He obtained a small reflecting telescope, and although it was comparatively inefficient, it showed him sufficient to make him determined that he must have the largest and most perfect telescope that could be procured. The purchase of such an instrument was far beyond his means, and there was only one way out of the difficulty—he must make a telescope for himself. This was a task calling for the highest skill, but in spite of his lack of knowledge and experience Herschel tackled it in full confidence of success.



Model of the great reflecting telescope built by Lord Rosse at Parsonstown, Ireland. This photograph and the one below are reproduced by permission of the Director of the Science Museum, South Kensington.

Herschel's activities at this period were extraordinary. He transformed his drawing room into a carpenter's shop; fitted lathes in his best bedroom; and built a furnace in the kitchen for melting down the materials necessary to cast the metal for the mirrors of his telescope. On one occasion this furnace collapsed, spilling the molten metal over the floor; and Herschel narrowly escaped serious injury. The production of the castings for the mirrors called for infinite patience and perseverance. Often a casting when complete would be found either too thin or too thick for his purpose, or one would crack in spite of the most careful handling.



Model of one of Herschel's reflecting telescopes.

The polishing of the mirrors was an even more tedious process, but Herschel never relaxed his determination to succeed. After giving a concert in the city he would rush home, and without waiting to remove his lace ruffles would immediately begin the task of grinding and polishing. Sometimes after weeks of patient polishing, night after night, until the required fineness of surface was achieved, a tiny scratch or flaw would be revealed and the mirror would have to be abandoned. In due course these tremendous efforts were crowned with success, and a telescope with the then large aperture of 5 in., was completed. Even this did not satisfy him, however, and subsequently he made still larger instruments.

An unexpected incident that occurred one night in 1780 proved to be a turning point in Herschel's career. He had taken one of his telescopes into the street in front of his house, and was deeply absorbed in the study of the Moon, when a passer-by asked permission to look through the telescope. This request was readily and courteously granted, and the stranger then introduced himself as Dr. Watson, a Fellow of the Royal Society. This meeting was the beginning of a lasting friendship, and shortly afterwards Watson's influence enabled Herschel to have his first paper on astronomical research read before the Royal Society.

On 13th March 1781, Herschel discovered the planet now known as Uranus and at once became world-famous. The Royal Society elected him a Fellow and awarded him a gold medal. His discovery was brought to the notice of George III, who commanded him to attend and give a personal account of his achievement. One of his telescopes was erected at Windsor so that the King might view the heavenly bodies for himself, and he was greatly fascinated by what he saw. The King appointed Herschel to be his private astronomer at a salary of £200 a year in recognition of his discovery of Uranus. Herschel subsequently moved to Slough, where he built a telescope having a mirror 4 ft. in diameter, and at that time the largest reflecting telescope in the world. It took four years to construct, and cost over £4,000. This bold enterprise attracted widespread attention, and there were many visitors to Slough to view the great telescope in the making. When the tube of the instrument was finished, visitors were allowed to walk through it as it lay on the ground.

This instrument, which was completed in 1789, enabled Herschel to penetrate farther into the depths of space than any other astronomer up to that time. The instrument was situated in the grounds of his home, and as it was fully exposed to the weather it required a great amount of care and attention to keep it in good condition. Herschel died at Slough in 1822, and the instrument remained in the grounds until 1840, when it was dismantled and transferred to a museum.

In his later telescopes Herschel did not follow Newton's form of construction. He dispensed with the small mirror near the top of the tube, and tilted the speculum so as to cause the light rays to be reflected direct to the eyepiece at the side of the tube. In this manner the light usually absorbed by the small mirror was saved and the image correspondingly brightened. The eyepiece was parallel with the tube, and not at right-angles to it as in the telescopes made by Newton; and this arrangement meant that the observer had to stand with his back to the object viewed in order to see the image reflected by the speculum.

A still greater telescope was built in 1842 by Lord Rosse at Parsonstown, Ireland. Lord Rosse was a man of many interests, including astronomy, and early in his career he resolved to construct a telescope that would achieve the limits of available power. He was fortunate enough to possess ample means, and in 1827 he began preparations for building a giant reflecting telescope. He had no previous experience of the work to guide him, and little was known of the processes by which Short and Herschel had made their telescope mirrors. Skilled workmen were not to be had, and Lord Rosse was obliged to obtain his assistants from among the farm hands on his estate, training them as best he could to serve as engineers and mechanics. In spite of these drawbacks he succeeded in constructing steam-driven grinding and polishing machines and other equipment necessary to carry out his scheme.

Another important problem was that of determining a suitable material of which to cast the metallic reflector, and for 12 years Lord Rosse experimented patiently before he succeeded in producing an alloy of copper and tin that fulfilled his requirements. Using this alloy he succeeded in 1839 in casting, grinding and polishing two mirrors each 3 ft. in diameter. These mirrors proved to be so perfect that he decided to make a larger one, and on 13th April, 1842, he succeeded in casting a mirror 6 ft. in diameter and weighing four tons. The grinding of this great mirror to the required curvature took two months; it was then polished, and when tested was found to be quite accurate.

The difficult problem of mounting this great reflector was solved by raising it upon 27 cast-iron platforms covered with felt, and supported by a system of levers arranged in such a manner that the weight was distributed uniformly. The tube of the telescope was 58 ft. in length and 7 ft. in diameter, and was constructed of deal staves bound with iron hoops. It was

(Continued on page 576

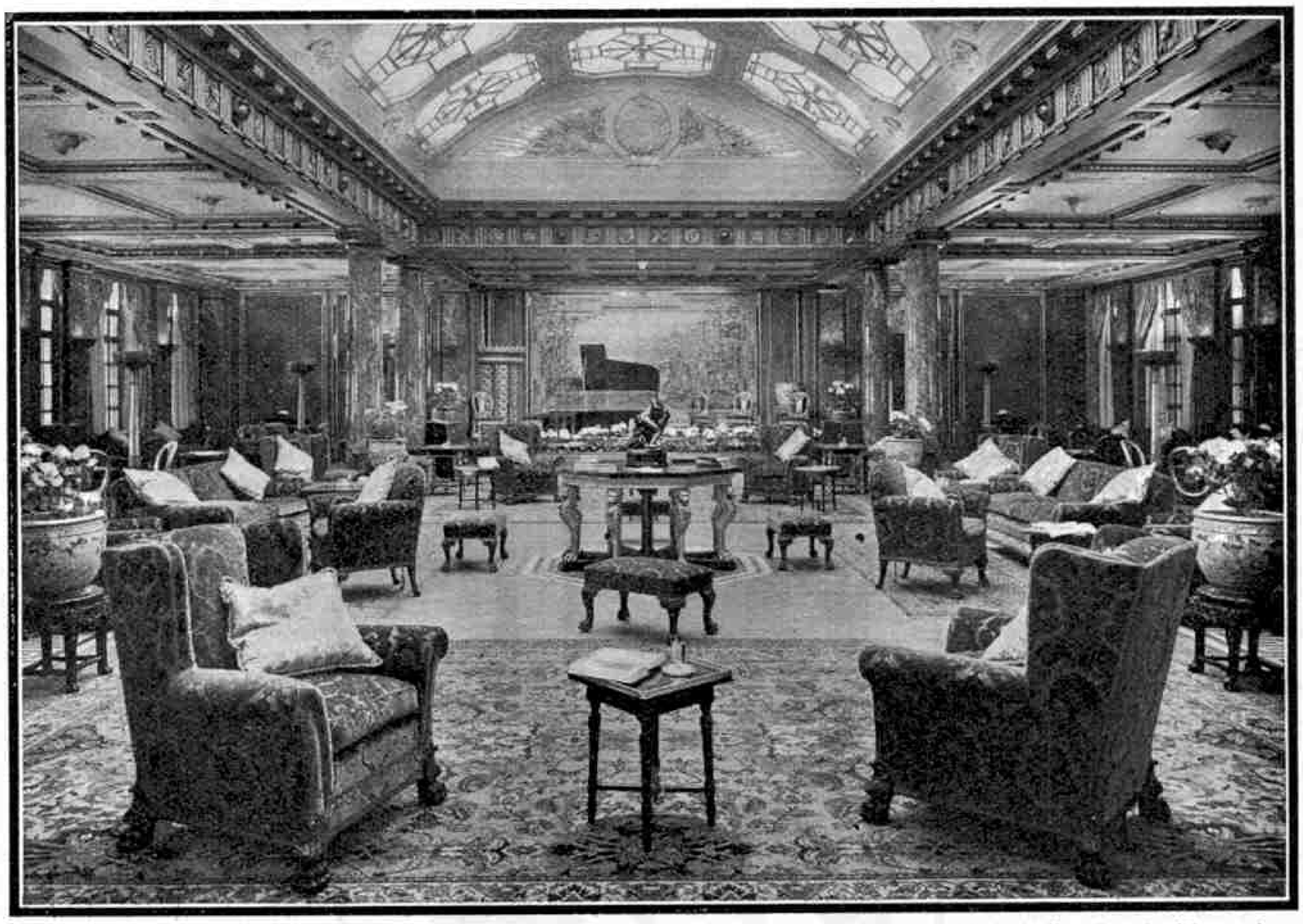
The "*Empress of Britain*"

A Triumph of British Shipbuilding

THE new Canadian Pacific liner *"Empress of Britain,"* which left Southampton on her first voyage to Quebec on 27th May, has aroused widespread interest. It is claimed that the new liner is the largest, fastest and most luxuriously appointed ocean-going vessel to ply between any two ports in the British Empire; and her propelling machinery represents an outstanding example of the latest high-pressure and high-temperature steam practice. The progressive policy of the Canadian Pacific line in creating during the past six or seven years a large and up-to-date fleet of ocean steamships of all classes has involved new construction and the re-engining of existing vessels on a large scale. One of the inducements to embark on this expenditure of many millions sterling, which has culminated in the building of the *"Empress of Britain,"* has been the economies in the cost of propulsion and operation that Mr. J. Johnson, the company's chief superintendent engineer, was able to offer through his new conceptions of high-pressure steam practice.

The hull of the *"Empress of Britain"* has been constructed by John Brown & Co. Ltd., of Clydebank, Glasgow; and the firm have also built and installed the main engines, gears, boilers, etc., under Mr. Johnson's supervision.

The vessel is propelled by four screws each driven by an independent set of single-reduction geared turbines of the Parsons type. To suit the conditions under which the ship will run—voyages between Great Britain and Canada during the summer and world cruises during the winter—the engines driving the two inboard screws are designed to develop two-thirds of the total power, while the engines driving the two outboard screws develop the remaining one-third. In other words, the power of the outboard engines is only half that of the inboard engines. Under cruising conditions, when full power is not required, only the inboard engines will be used, and the vessel then will be virtually a twin-screw ship. The machinery has been designed to develop normally a total output of 60,000 S.H.P. continuously at sea in order to maintain a normal speed of 24 knots. If an increase of speed should be necessary at any time, however, an overload power of 64,000 S.H.P. can be maintained for long periods.



The "Mayfair" Lounge, one of the magnificently decorated public rooms of the "Empress of Britain." For the illustrations to this article we are indebted to the courtesy of the Canadian Pacific Railway Company.

Two engine-rooms are necessary for the main propelling machinery, the two inboard sets being arranged in a compartment forward of that in which the two outboard sets are installed. Some of the auxiliary machinery is situated in a separate auxiliary engine-room immediately forward of the two main engine-rooms.

The main turbine sets each comprise one high-pressure, one intermediate-pressure and one low-pressure turbine, working in series; and each turbine drives a separate pinion, which engages with the main gearwheel. For astern running a high-pressure unit is incorporated in the same casing with each of the two intermediate ahead turbines, and a low-pressure unit in the exhaust end of each of the two low-pressure ahead turbines of the inner-shaft machinery only. No provision is made for astern working on the outer shafts, which are employed exclusively for ahead duty. The astern turbines are capable of developing 60 per cent of the aggregate ahead service power.

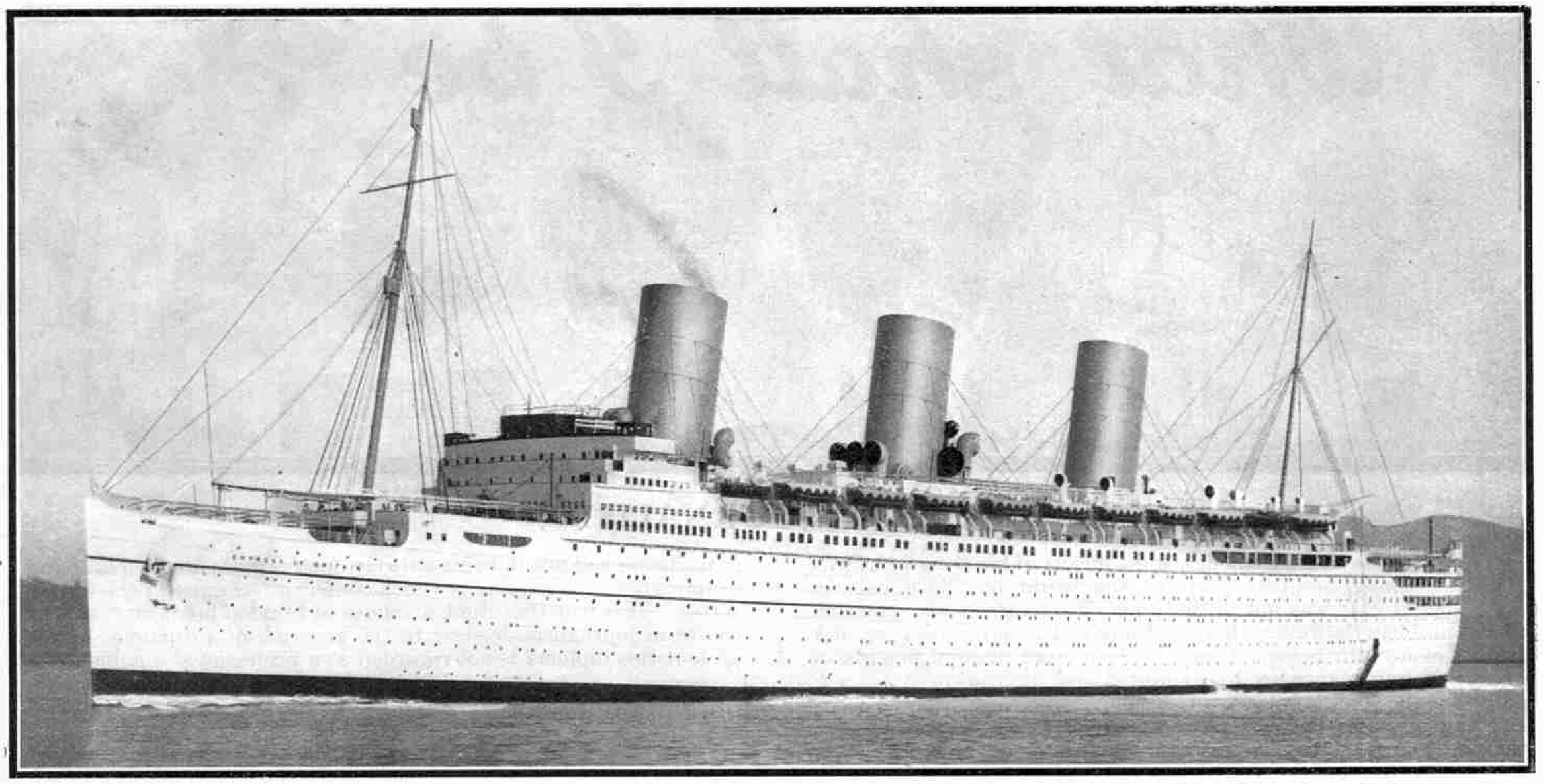
The main gearing is of the usual double-helical single-reduction type, and the main gearwheels of the inner and the outer shafts have diameters of 14 ft. 6 in. and 11 ft. 3½ in. respectively. The thrust of the propellers is transmitted to the vessel through Michell thrust-bearings of the single-collar type fitted to the main lines of shafting immediately aft of the gearing; and the tunnel shafting is supported by bearings of the Michell pivoted-pad journal type.

The propellers, which are of solid bronze, have diameters of 19 ft. 3 in. and 14 ft. for the inner and outer shafts respectively. When developing the normal service power of 60,000 S.H.P. the speeds of the propellers are 150 and 200 r.p.m., and the corresponding speeds of the turbines are 1,365 and 1,795 r.p.m. for the inner and outer shafts respectively. The reduction ratio therefore is about 9:1.

The boiler installation consists of eight oil-fired water-tube boilers of the Yarrow type, and one oil-fired water-tube boiler of the Johnson type. The boilers are arranged in two compartments, and the same principle of division of power has been carried out in the boiler arrangement as with the main engines. Six of the boilers are placed in the after boiler-room, normally supplying the forward inboard engines; and three boilers are installed in the forward boiler-room, supplying the outboard engines in the after engine-room. The arrangements are such that all or any of the boilers can supply the ahead and astern turbines in the forward engine-room.

The Yarrow boilers are of the double-flow side-fired type having one steam drum, three water drums and one superheater drum. The flow of the gases is through both sides of the boiler, after which it passes through a large tubular airheater, and from there to the funnel. The power and superheater drums are hollow rolled forgings with ends formed integrally, and they represent the latest practice for high-pressure boiler work.

The Johnson boiler consists of two large diameter drums placed vertically one above the other and connected to each other by curved tubes, which are arranged longitudinally and across the ends in such a manner that the combustion space is almost entirely enclosed by water tubes. In addition there is a wall of water tubes along the centre of the boiler, which divides the combustion space into two separate compartments. This arrangement of tubes provides for a considerably larger amount of tube surface exposed to radiant heat than in other types of marine



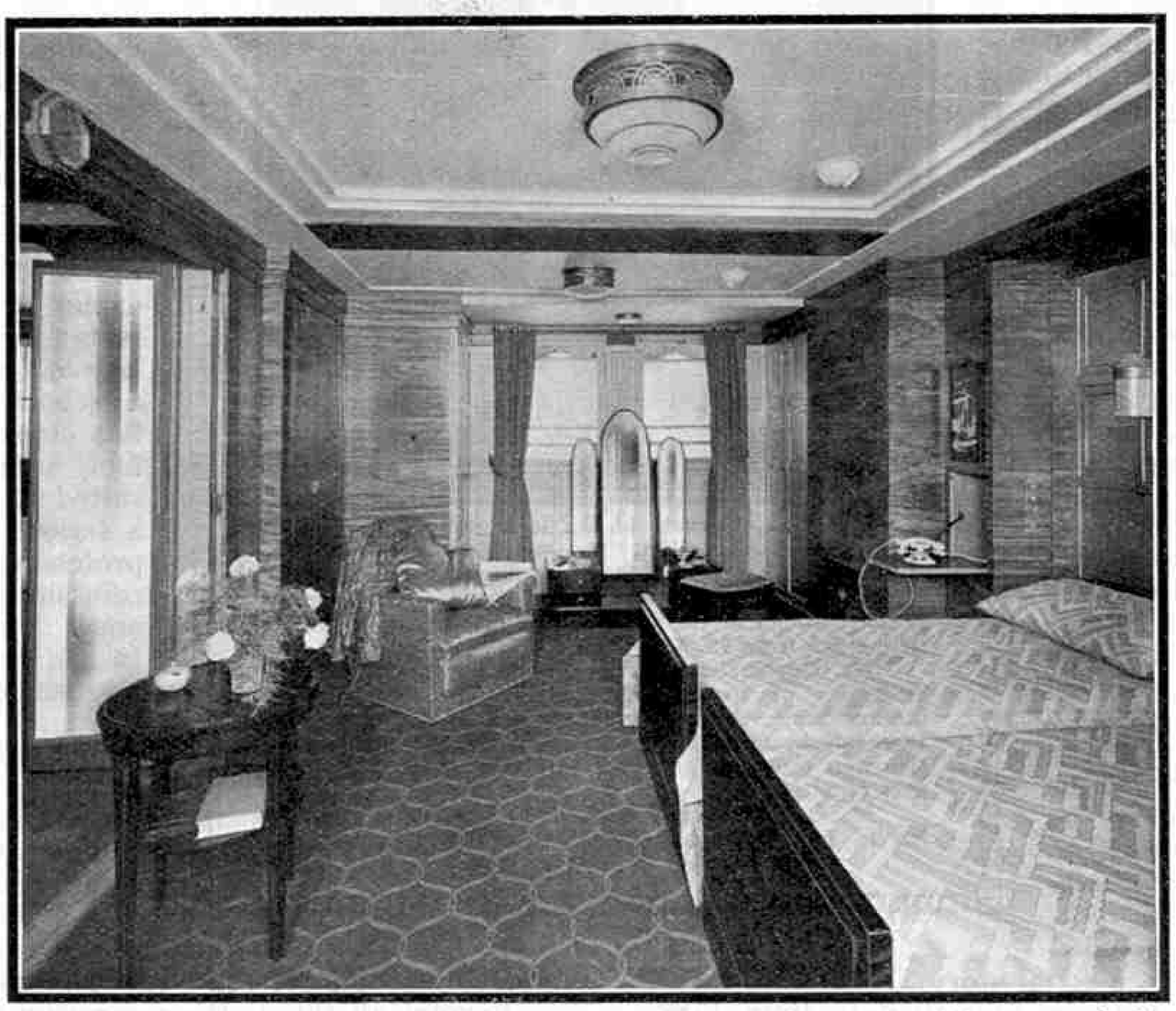
The " Empress of Britain," the new 24-knot Canadian Pacific liner. She is the fastest ocean-going vessel to ply between any two ports in the British Empire, and makes the crossing between Southampton and Quebec in five days.

water-tube boilers. The boiler was constructed at Clydebank, and a series of trials showed that it is capable of generating double the amount of steam per square foot of heating surface, while registering the same efficiency as a Yarrow or other standard type of boiler working at ordinary mercantile rating.

In the separate compartment between the forward main engine-room and the after boiler-room are situated four electric generators, each of which has an output of 450 kw. and is driven by a Fiat British Diesel single-acting two-stroke cycle four-cylinder engine developing 660 B.H.P. at 260 r.p.m. In addition there are two British Thomson-Houston turbo-driven generators of 800 kw. situated in the forward main engine-room.

It is understood that during her tests on the Clyde measured mile, and in the open sea, the "*Empress of Britain*" set up a new world's record for economy in oil fuel consumption. Using only 0.57 lb. of fuel per S.H.P. per hour, she developed a speed of 25.52 knots; and under cruising conditions, with only two of her four engines working, she maintained 22.6 knots. The results of these trials indicate that the vessel will be able to make the passage between Southampton and Quebec in under five days, the open-sea period being less than 3½ days.

The "*Empress of Britain*" is 758 ft. in length overall, 97½ ft. in breadth and 60¾ ft. in depth. Her gross tonnage is 42,500. A shelter deck extends the full length of the vessel, and above it are a promenade deck of three-quarters the length, a boat deck for half the length, and a sun deck above this. Three funnels of pear-shaped section tower 68 ft. above the sun deck, and the masts, about 208 ft. above the load water line, are the highest yet built in the Clydebank yards. The vessel has a straight stem raking well forward, and a cruiser stern. She is adequately sub-divided with watertight bulk-heads, and possesses a perfect equipment of life-saving apparatus, including every form of wireless and signalling. She has boats for the full number of passengers and crew, including motor-boats fitted with wireless and searchlights, emergency boats, and the latest buoyancy apparatus. She has accommodation for 423 first-class passengers, 260 tourist third cabin, and 470 third-class.



One of the de-luxe apartment suites of the vessel. Each suite includes spacious living room, double bedroom, bathroom, servants' room and ample luggage room, and is as secluded as a private residence on shore.

The passenger accommodation has been planned on the most modern and up-to-date lines, a particular feature of the first-class staterooms being that they are all outside rooms having direct light through the ship's side. The tourist third cabin staterooms are based on the cabin staterooms of the "Duchess" class of steamships, and the third-class are superior to anything yet fitted for this type of passenger. All the first-class state rooms are fitted with bedsteads of large size, large dressing tables having a cabinet on top with triple folding mirrors, a fixed wardrobe for each passenger, and other conveniences.

The first-class public rooms are planned on a sumptuous scale. They have been designed by famous artists, including Sir John Lavery, Mr. Frank Brangwyn, Sir Charles Allom and others; and Mr. Heath Robinson has peopled the children's nursery in his well-known whimsical fashion with the favourites of nursery lore. The swimming bath is framed on a magnificent scale. The surroundings include glass mosaic columns under a glass roof, woodwork of carved teak, and a spectators' gallery.

The "*Empress of Britain*" was launched by the Prince of Wales on 11th June, 1930.

XXI.—A JOURNALIST

AS far back as history reaches, some means of knowing what was happening in other parts of the world has been eagerly sought. It was not until Julius Cæsar turned his attention to the problem, however, that anything in the nature of a regular system came into being. Cæsar ordered brief announcements of events of importance to be exhibited daily in the public places of Rome, and these notices may be regarded as the first journal. No charge was made for reading the notices, and it was not until some centuries later that the providing of news became commercialised. This occurred in 1556 in Venice, where those who wished to read the official news sheets then posted by the Senate had to pay a small coin called a *gazetta*. From this word the familiar modern word "gazette" is derived.

Perhaps the first hint of what would now be called newspaper activity in Great Britain is to be found in the story that a man named Fenn acted as a kind of war correspondent during the Wars of the Roses. Rather more than 100 years later news letters came into existence. These letters were written in London and despatched to subscribers in the city or in the provinces. They were not issued daily, but were sent out as occasion demanded. The following century saw a gradual increase in the importance of news letters and their transformation into true newspapers.

Early in the 18th century a great change was effected by Daniel Defoe, who has been called the "father" of journalism. Defoe is best remembered as the author of "*Robinson Crusoe*," the most popular boys' book ever written. As a young man he took part in Monmouth's rebellion, and served as a volunteer with the Prince of Orange who afterwards became William III. In the reign of Queen Anne he served a term of imprisonment for writing a pamphlet in ridicule of the ruling Church Party. During his imprisonment he began a weekly periodical called the "*Review*," which he continued to publish after his release. Eventually this paper appeared three times a week, and among other features it included what would now be described as a serial story.

The modern newspaper era may be said to date from 1788, when "*The Times*" came into existence. Its producer was John Walter, who had formerly been an underwriter at Lloyd's. During the 19th century a very powerful London and provincial press grew up. The demand for news increased steadily as the standard of education rose, and when the tax on paper was removed the newspaper took its position as the provider of daily information on matters of interest in all parts of the world.

The profession of journalism is a difficult one to write about from the point of view of a career. It differs from such professions as medicine and law in being entirely open; there are no qualifying examinations the passing of which confers a recognised professional status. It is true that the University of London holds an excellent course in journalism, leading to the granting of a diploma, but at present this diploma is not regarded as a professional qualification. Indeed in some journalistic circles anything in the nature of a "course" in journalism is still regarded with dark suspicion. There seem to be almost as many methods of entrance to journalism as there are branches of the profession itself. The Institute of Journalists, an organisation that every journalist should join, has had under consideration for some time a scheme of examinations for admission to the profession, but the conditions of journalism are so peculiar that up to the present nothing practical has been accomplished.

Before coming to actual entrance upon the career of journalism it is necessary to say something about the qualifications that must be possessed to ensure success. There is a certain apparent romance about the profession that has induced many to enter it who were utterly unsuited to the work. Many boys have written to the Editor of the "*M.M.*" stating that they intended to become journalists, and asking for advice. In nearly every instance enquiry has shown that the boy has had a few articles published in a school magazine or elsewhere, and has come to the conclusion that this fact indicates that he is specially suited to a journalistic career. This is a serious mistake. Probably no other profession calls for such a varied combination of abilities, and certainly none demands more strenuous work. In addition to the ability to write good English, the journalist must have wide all-round knowledge, a vivid imagination, a keen interest in the everyday affairs of the world, and the power of recognising instantly events that have "news value." This last qualification, which is often described as "a nose for news," is absolutely essential, and a person who does not possess it naturally can never acquire it to the necessary extent.

Beyond all this is the possession of robust health. A reporter must be prepared to go anywhere at any time and stick on the job in hand until it is finished, no matter whether conditions be pleasant or unpleasant. At all costs he must get the news, otherwise his paper has no use for him. It might be thought that the sub-editor, whose work is carried on inside the office, would have a less strenuous time, but this is not the case. He has to work at continuous high pressure, and on a morning paper far into the night; and the mental strain, particularly towards the time for going to press, is very great. In varying degrees the same concentrated effort is

A Famous Journalist

Mr. J. L. Garvin, LL.D., is a journalist with an international reputation. He has been Editor of the "Observer" since 1908, and was formerly Editor of the "Outlook" and the "Pall Mall Gazette." He was also Editor-in-Chief of the 14th edition of the Encyclopædia Britannica from 1926 to 1929.

Mr. Garvin has written several books, including a biography of Joseph Chamberlain. His most notable literary work is a volume entitled "The Economic Foundations of Peace," a remarkable book on reconstruction problems after the war that attracted a great deal of attention.

Mr. Garvin was President of the Institute of Journalists in 1917-1918, and Chairman of the Empire Press Union Council in 1926.

demanded of all journalists, and the man who is not physically fit is liable to break down under the strain.

Two other points require careful consideration. The first is that the salaries paid in journalism, taken as a whole, are not in proportion to the strenuous nature of the work demanded in return. A competent journalist can earn a good living, but the really big salaries are confined almost entirely to the editors and special writers of important dailies. The second point is that there is at present a great deal of unemployment in journalism, due to amalgamations of newspapers and other causes.

Two main courses are open to a boy who wishes to become a journalist. One is to secure a post in a newspaper office immediately after leaving school; the other is to obtain a University degree and then commence practical work.

The first method is regarded by many experienced journalists as the better of the two, because from the outset a boy is acquiring practical knowledge. A boy who intends to adopt this course should secure a good all-round education up to matriculation standard. He should give a great deal of attention to English, with the object of cultivating an easy, interesting and intelligible style of writing. In addition to his regular school work he should practise writing short essays on the greatest possible variety of subjects, treating each one as seriously as if it were to be read by thousands of people. A journalist should be able to throw himself enthusiastically into any subject that comes along, and as a result to write about it with enthusiasm. Without this spirit behind it, the writing is lifeless and unattractive to the reader. Compression plays a large part in a journalist's work, and it is good fun to practise this. For instance, a paragraph from a book or newspaper should be selected and the words counted. Then the fun begins by trying to write and rewrite this paragraph in a smaller and smaller number of words, always retaining the essential facts. This kind of thing is splendid practise, and becomes almost exciting when the point is reached at which it seems to be impossible to take out even one more word.

Sub-editors of a modern newspaper at work. They edit the news and supply the necessary headings and sub-titles before sending it by automatic tube to the composing room, where the overseer or foreman distributes it among the linotype operators to be set up in type. Our illustration is reproduced by courtesy of the "Daily Express."

We come now to the question of shorthand. At one time the value of the ability to write shorthand at a very high speed was overestimated; nowadays there is a tendency to go to the other extreme. In some quarters it is rather fashionable to pretend that shorthand is not necessary, and in proof of the statement to point to certain undoubtedly successful journalists who do not write shorthand. Such men are exceptional, however, and for the vast majority of journalists there can be no possible doubt that the ability to write shorthand is, if not essential, at least extremely useful. The best advice that can be given to a boy is to tackle shorthand resolutely while he is at school, and to work up his speed by every possible form of practice until he is able to follow without difficulty a medium-paced speaker. When it comes to applying for a post on a newspaper, the possession of such a shorthand equipment will carry considerable weight.

There can be little doubt that the best type of paper on which to commence a journalistic career is a good class weekly. The main reason for this is that the staff of such a paper is necessarily small, with the result that there cannot be much division of labour. Thus the beginner has to take things as they come, and in so doing he acquires a valuable all-round practical knowledge that will stand him in good stead in his subsequent career. A post on such a paper may be obtained by personal application, through the introduction of friends, or through advertising, or answering advertisements.

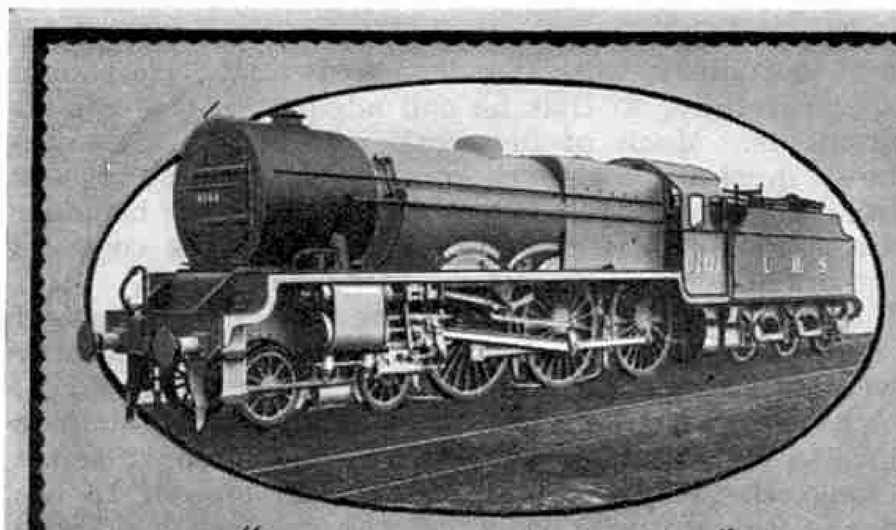
During this preliminary stage of his career the young journalist should definitely set himself to learn as much as possible about every branch of journalistic work that comes his way. He should study his paper carefully, so that he can adequately provide its special requirements. Much of his work will be dull and uninteresting, but it must all be done thoroughly and with unflagging keenness. In addition to his purely journalistic work the beginner should acquire a good practical knowledge of how the copy he prepares is set up in type and printed.

The length of time that a youth should remain in this class of work varies according to circumstances. In some cases he may progress so well on his paper that he is not in a hurry to leave it; in other cases he feels that there is little scope, and he is anxious to make a move to some other paper. In any case he must decide before very long whether he intends to devote himself to the reporting or the sub-editorial sides of the profession. Little purpose would be served in trying to follow the career of the young journalist beyond this point, for circumstances differ so much that general advice is mostly useless. There is ample scope in many directions for young men with the necessary qualifications, provided that each opportunity as it arises is promptly and energetically seized.

The boy who passes from school to University and obtains a degree before commencing practical journalistic work will of course not expect to begin at the very bottom in the manner we have described. At one time there was a tendency in journalistic circles to regard the University graduate as useless in comparison with the office-trained working journalist; but it is now realised that for many branches of the profession the University-trained man is specially suitable, provided that he has the necessary adaptability and is prepared to tackle the practical side of the work in real earnest.

We have already referred to the diploma course in journalism instituted by the University of London. This is open to matriculated students of the University who are not less than 17 years of age. In exceptional circumstances students who have not matriculated may be accepted, but they must have attained the age of 18. The course lasts for a period of two years, during which fees of 28 guineas per session are payable. In addition to the regular work of the course every effort is made to arrange for students to spend part of their vacations on the staff of a newspaper, thus obtaining an insight into practical journalism. Although, as we have said, this diploma is not regarded as a professional qualification, its possession undoubtedly affords proof of a sound all-round education, with special reference to journalistic work. For this reason an employer would certainly give preference to a youth holding the diploma. There are various opinions about the value of the course as a whole, but it is at any rate a step in the right direction. It can be thoroughly recommended to boys who are unable to take a University degree, but at the same time desire to provide themselves with a sound educational equipment.

The all-round journalist provides the foundation for newspaper work, but in addition there is ample scope for the specialist. A young journalist who has a special interest in any subject or group of subjects is well advised to cultivate this and to seize every possible chance of work in this sphere, with the object of ultimately confining himself entirely or largely to it. Specialist posts are of course few in comparison with those of an all-round nature, but the effort to secure one of them is well worth making by any young journalist who has a real enthusiasm for a special subject, whether it be sport, music, art or the theatre. Other opportunities for the specialist are provided by the various technical and trade papers, which have grown rapidly in importance during recent years, and are likely to continue to do so.



RAILWAY NEWS

Summer Rail Services

The British Railways are all ready for the great summer holiday rush, and during the season they expect to carry 400 million passengers to and from all parts of the country. For months past preparations have been proceeding and this year the Railway Companies claim to offer the most extensive, convenient and comfortable rail service ever provided.

The new time-tables do not reveal any exceptional accelerations to the main-line expresses, but many local services will be considerably improved. For instance the G.W.R. will save 2,760 minutes, or 46 hours, daily in the speed-up of the local services all over their system. Similarly on the L.M.S.R., 778 local and semi-express trains will be quickened to save 2,552 minutes, or 43 hours a day.

The G.W.R. *"Cornish Riviera Express"* will again run non-stop between Paddington and Plymouth, covering the 225¾ miles in 4 hours. The 6-20 p.m. express from Plymouth is being accelerated to arrive at Paddington at 11-20 p.m. instead of 2-40 a.m. A fast night service to the West of England will be provided by a new train leaving Paddington at 1-40 a.m.

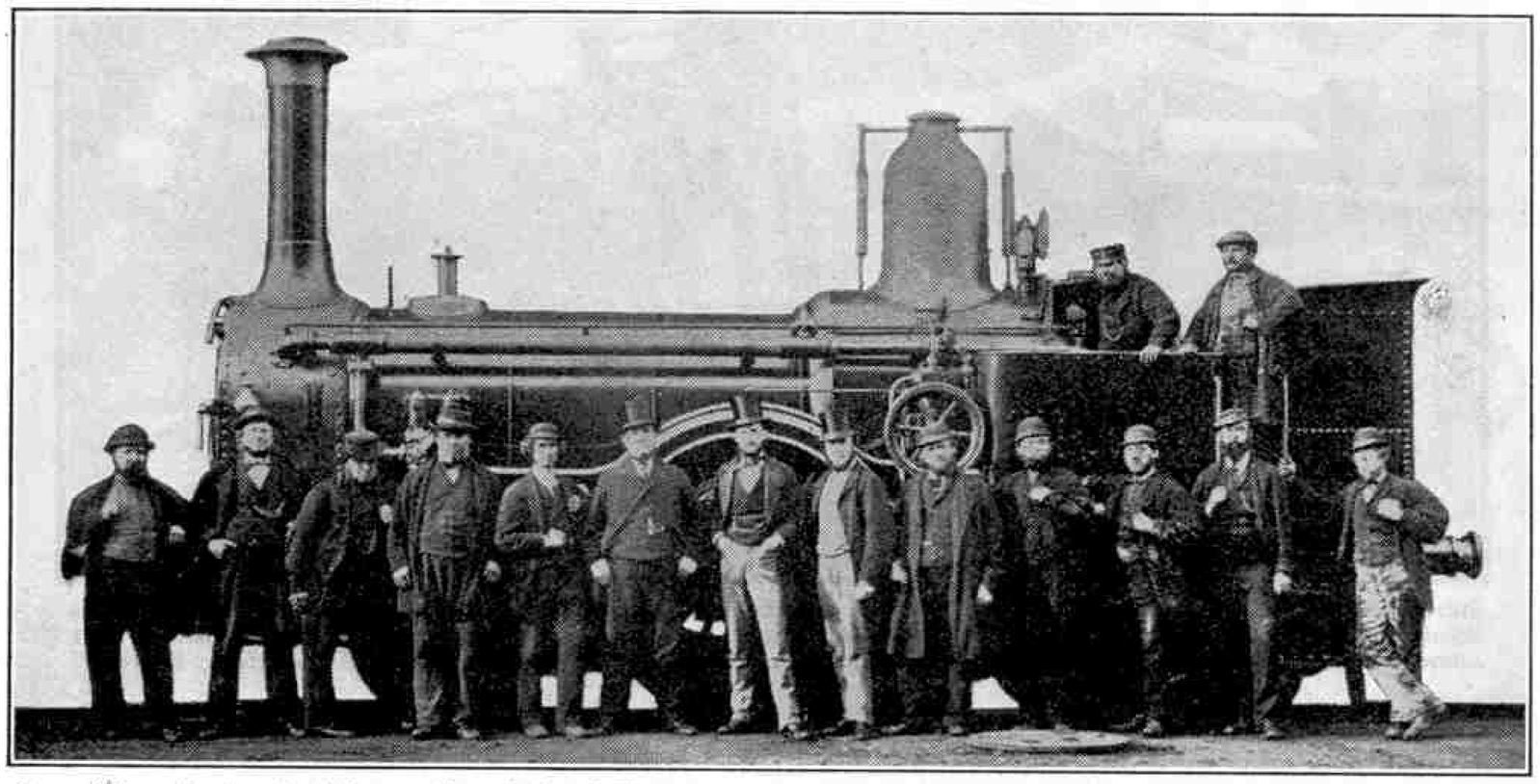
On the L.N.E.R. the *"Flying Scotsman"* will again perform the world's record non-stop run daily in both directions between King's Cross and Edinburgh—a distance of 392¾ miles—and will be followed at 10-5 a.m. by an additional express stopping at Grantham, York, Newcastle, Berwick and Edinburgh. The *"Scarborough Flier"* will leave King's Cross at 11-50 a.m. daily, stopping only at York and reaching Scarborough in 4½ hours. There will be a similar train leaving Scarborough at 10-45 a.m. and arriving at King's Cross at 3-15 p.m., York being the only stop.

A new express, *"The Norseman,"* will leave King's Cross every Saturday at 1-5 p.m. for Tyne Commission Quay, Newcastle, in connection with the steamers for Bergen.

No less than 1,200 new trains are scheduled by the L.M.S.R. for the holiday season, including *"The Lakes Express," "The Pines Express,"* and *"The Welshman."* *"The Royal Scot"* will again make the run of 300 miles between Euston and Carlisle non-stop in both directions.

The Southern Railway is a great holiday line and will operate a greatly increased service during the summer months to all the resorts within its territory. The new all-Pullman express, the *"Bournemouth Belle,"* will run daily between London and Bournemouth in addition to the *"Bournemouth Limited."*

Improved continental services will reduce the time between London (Victoria) and Vienna by 7½ hours. The boat services between Southampton and St. Malo will run to a regular time-table instead of being an irregular, tidal service as in the past.



One of the suburban tank locomotives designed 70 years ago by Mr. Joseph Beattie for the L.S.W.R. These engines were known as "Swan-necks" because of their tall chimneys. Three of them survive and are still employed on the Bodmin-Wadebridge branch of the S.R. (Photograph, Railway Photographs, Liverpool).

Roller Shutters on S.R. Corridor Trains

The Southern Railway has equipped one of its trains with a new type of roller shutter between the corridor coaches. The new shutter is similar to the kind now largely used for garages and shop fronts. It is made of metal and is readily controlled by a spring that secures it either in the open or closed position.

One of the advantages of the new system is that the shutters may be closed from inside or outside the coach, and are much more simple to operate than the types now in use. At the moment the invention is still in the experimental stage, but if successful it will enable trains that divide at junctions to be dealt with in a shorter time than older methods allow. At present uncoupling, and the disconnection and closing of the gangways, is quite a laborious process.

L.N.E.R. Locomotive News

Darlington works have completed further engines of the 4–6–0 "Sandringham" class which are numbered and named as follows:—2829, *"Naworth Castle"*; 2830, *"Thoresby Park"*; and 2831, *"Serlby Hall."* Additional engines of the "K3" 2–6–0 class have been delivered by Messrs. Armstrong Whitworth & Co. They carry the numbers 1106, 1108, 1117 and 1118.

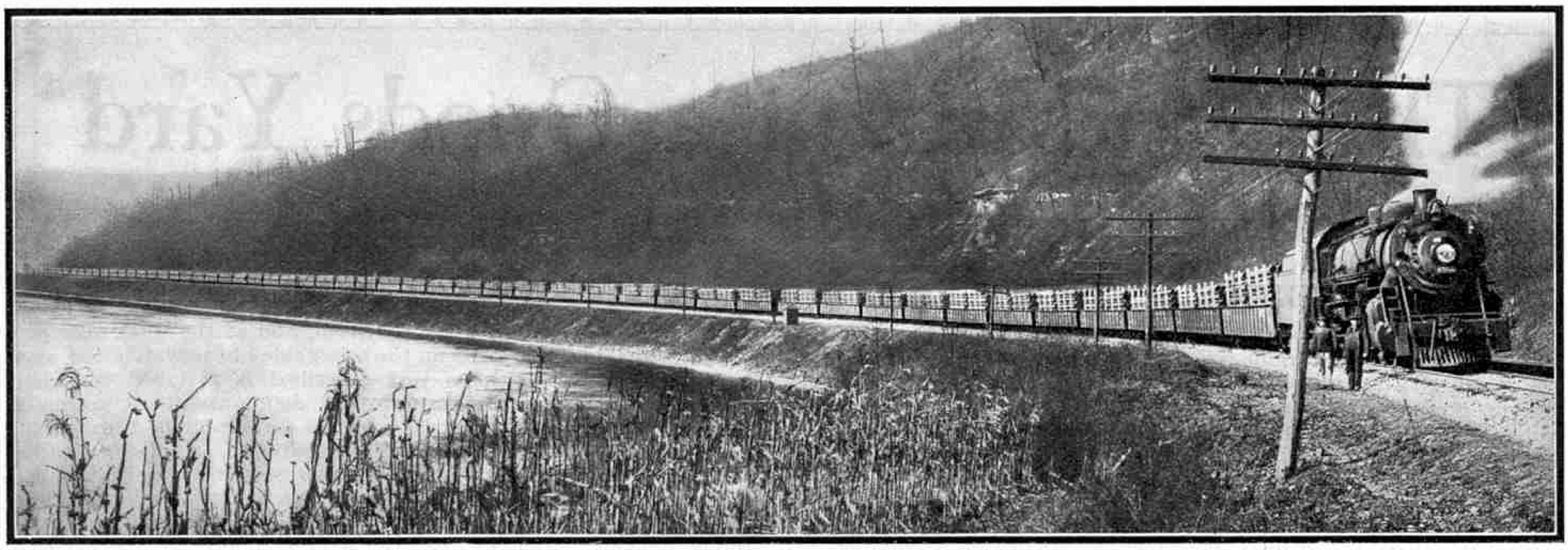
One of the new Doncaster-built 2–6–2 three-cylinder tank engines—No. 2911—is stationed in the London area and has been working empty carriage-stock into and out of King's Cross Station.

Engines Nos. 8502 and 8503, of the Great Eastern 4–6–0 inside-cylinder type, have been sent to work on the Great North of Scotland section.

The recent scrapping of the 4–4–0 engine No. 1619 marks the end of another notable locomotive. It was first built in 1893 for the North Eastern Railway as a two-cylinder compound, to the designs of Mr. Wilson Worsdell. It was given a pressure of 200 lb. per sq. in., at that time the highest on any British locomotive, when it was rebuilt in 1898 as a three-cylinder compound on W. M. Smith's system.

Train Control on the G.W.R.

The whole of the G.W.R. main line to the West of England, from Paddington to Plymouth, both via Westbury and Bristol, has now been brought under the automatic train control system. It is expected that the work of installing this system on all the main-line routes of the G.W.R. will be completed by the end of this year, when 2,130 miles of track and 2,500 engines will have been equipped. It will result in safer working and better time-keeping on both passenger and freight services. As explained on page 198 of the *"M.M."* for March, 1931, in this system audible warning is given to the driver when he is approaching a distant signal at danger. If he disregards the warning and does not prepare to slow down and stop at the next home signal, the brakes are automatically applied.



The " Eastern Steel Special " of the Baltimore and Ohio Railroad conveying steel from Pittsburgh to the eastern seaboard. This is one of eight " Steel Specials " that are operated daily on the Baltimore and Ohio Railroad, to whom we are indebted for our photograph.

American " Steel Specials "

During recent years steel has risen to a place of enormous importance among building materials. This is particularly the case in the United States where, combined with brick and cement, steel has enabled man to erect the gigantic structures that tower into the sky. Because of the limited space available for the storage of material in the larger cities near the site of building operations, it is necessary that steel should be brought from the producing centres as quickly as possible, in order not to delay the building work. In co-operation with producers, merchants and consumers, the Baltimore and Ohio Railroad operate eight " Steel Specials " daily from the great steel centres.

From Pittsburgh, Pennsylvania, a city noted all over the world for its steel industries, there are operated three daily steel specials. The *"Southwest Steel Special"* carries its massive loads to East St. Louis, where the cars are interchanged for transport to the south-western section of the United States. Steel products destined for the western sections of the country, and for export from the western seaports, are conveyed by the *"Western Steel Special,"* with Chicago as its destination. Points on the eastern seaboard, such as Baltimore, Philadelphia and New York, are served by the *"Eastern Steel Special."*

Three steel specials are operated daily from Youngstown, Ohio, another important steel-producing centre. These are known respectively as the *"Detroit Steel Special,"* the *"Youngstown Steel Special—East"* and the *"Youngstown Steel Special—West."* Another important train, known as the *"Johnstown Steel Special,"* is operated from Johnstown, Pennsylvania, to New Castle Junction in the same State, where the cars for western destinations are transferred to the *"Western Steel Special"* from Pittsburgh. The steel products of Dover and Massillon, Ohio, require the operation of a train from those points to the west, and the *"Dover-Massillon Steel Special"* meets the demand.

These eight steel specials of the Baltimore and Ohio Railroad are run on regular schedules arranged so as to move the whole of the current day's production from the steel mills. The trains are classified among the most important freight trains and receive special attention from the railway operating staffs, who endeavour always to get them through to their destinations on time.

First "Jubilee" Engine Scrapped on S.R.

Some of the new 2–6–0 engines of the " U " class have been completed at Ashford works and are now in service. They have tenders of the " Schools " type, with the side-sheets set inward at the top. Nos. A.630 to A.635 are already out. A correspondent reports that he travelled recently behind A.630 on a London (Victoria) to Eastbourne train, when some smart running was done.

At Eastleigh, work has been commenced on 15 new freight tank engines. They will have the 2–6–4 wheel arrangement, 5 ft. 6 in. drivers, and three cylinders.

The " Kent Coast Express " of the Southern Railway hauled by 4-4-0 locomotive No. A247. This engine is one of a class of which many were reboilered and superheated by Mr. R. E. L. Maunsell. (Photograph, Railway Photographs, Liverpool).

Among the engines scrapped lately have been several of the 0–4–2 mixed traffic class. They were popularly known as "Jubilees" because the first ten were built at the L.S.W.R. works at Nine Elms in 1887, the year of Queen Victoria's Jubilee. They had 6 ft. 1 in. driving wheels and inside cylinders of 18 in. diameter and 26 in. stroke. Ninety in all of the class were built. They have been very useful engines, able to work almost any type of train. The engines that have been sent to the scrap-heap include No. E.527, the pioneer of the class.

New " Halls " on the G.W.R.

At Swindon the building of the new engines of the 4–6–0 " Hall " class has been pushed forward rapidly and the remaining fifteen engines, completing the present order, will be in traffic by the beginning of July. They will bear the following numbers and names:—5906, *"Lawton Hall"*; 5907, *"Marble Hall"*; 5908, *"Moreton Hall"*; 5909, *"Newton Hall"*; 5910, *"Park Hall"*; 5911, *"Preston Hall"*; 5912, *"Queen's Hall"*; 5913, *"Rushton Hall"*; 5914, *"Ripon Hall"*; 5915, *"Trentham Hall"*; 5916, *"Trinity Hall"*; 5917, *"Westminster Hall"*; 5918, *"Walton Hall"*; 5919, *"Worsley Hall"*; and 5920, *"Wycliffe Hall."*

Further 2–6–2 tank engines have now been put in hand. They will be numbered 6110-9.

Engine 2935, *"Caynham Court,"* the 4–6–0 locomotive fitted with Lentz poppet valves, is undergoing a thorough series of tests. On the first trial run a speed of 75 m.p.h. was easily attained with the reversing gear notched back almost to mid-gear. Its first trip up to London was made at the end of May.

" Royal Scot " Locomotives in North Wales

Following on the completion of the order for 0–8–0 freight engines, a batch of ten 2–6–0 mixed-traffic locomotives has been put in hand at Crewe. They are to be numbered 13225 to 13234. The latest 2–6–2 tank-engines turned out from the works at Derby are numbered 15540-4 and have been sent to work in the Birmingham area.

Engine No. 6146, *"Jenny Lind,"* of the " Royal Scot " class, is now stationed at Bangor. It works one day from Bangor to London, taking a stopping train to Llandudno Junction, proceeding thence on the 9 a.m. express, and reaching Euston at 1-25 p.m. It returns on the following day on the 10-35 from Euston. During the summer season it will be employed on the non-stop express *"The Welshman."* Six " Royal Scots " are stationed at Holyhead, and are employed in working the London-Holyhead expresses.

Another engine of the 4–4–0 " Renown " class—No. 5172, *"Cavalier"*—has been broken up at Crewe.

The Working of a Goods Yard

How a Typical Goods Train is Assembled

TO the casual observer the scene in a busy railway depot where a large volume of traffic is handled suggests hopeless confusion and absolute disorganisation. This impression is entirely wrong, however. It is only necessary to watch carefully for a while in order to realise that beneath the apparent hurry and disorder there is a definite system, but the smoothness and accurate operation of this system can only be realised by those who thoroughly understand it.

The interesting section of the goods depot is the warehouse, where the "small" traffic known as "c and d"—is handled. This traffic is collected by the railway from the consignor and delivered to the consignee. The warehouse is divided into two sections handling respectively the "outward" and the "inward" traffic. These terms refer to rail-borne traffic. Thus, at the "outward" section all traffic coming *into* the station for despatch by rail is dealt with. From an early hour in the morning lorries may be seen streaming into and out of the depot, some with loads already collected from the public, others taking out loads for distribution. As the incoming lorries arrive at the warehouse they are backed up to the loading platform, on the opposite side of which railway wagons are standing empty. A checker in charge of a gang of porters meets each vehicle and as its contents are passed out he checks each individual item against the consignment notes and instructs the porters to which section of the loading platform the goods have to be transferred.

A three-cylinder 8-coupled tank engine specially designed for shunting work. Ample power is afforded by the cylinder and wheel arrangements adopted, and a moderate grate area avoids unnecessary fuel consumption when the engine is standing.

Large numbers are suspended at various points along the platform and each of these indicates the position of a particular section, opposite which goods for a particular destination or route are being loaded. In some warehouses the numbers are replaced by the actual names of the destinations for which goods are being loaded. Sometimes the goods may be loaded straight into the wagons waiting at the appropriate section, but usually it is not convenient to deal with the traffic immediately, and it is placed in position to await the attention of a loading gang.

The loading of a railway wagon is an art and calls for a high degree of skill. It would not do to put heavy bales of, say, cloth on top of fragile cases of hats; neither would it do to put bags of nails on top of rolls of cotton. Every item of traffic must be packed carefully and tightly to minimise the risk of damage in transit, and at the same time every effort must be made to use every available inch of space. Unskilful loading may be as fruitful a source of waste as unskilful labour in any other walk of life.

In a busy depot it is often impossible to place sufficient railway wagons alongside the platform in one line to cover all the special destinations provided for. In such cases gaps are left between the wagons immediately alongside the platform and bridges are thrown across the gaps to wagons standing upon a second line. Cranes are installed at frequent intervals up and down the shed, so that no matter what the position of a lorry or railway wagon, goods can be lifted out and transferred with ease. As the wagons are completely loaded up they are pulled out from the warehouse by a shunting engine or a horse, or possibly by a tow rope connected with a hydraulic capstan in the yard outside. More empty wagons take their place alongside the platform, and so the work goes on.

The "inward" section is on the other side of the warehouse, and here the process we have just described is reversed. Loaded railway wagons are brought into the depot and their contents are removed and distributed to lorries for despatch throughout the local delivery area. Just as the "outward" traffic had to be distributed to particular railway wagons, so the "inward" traffic has to be sorted and distributed to particular road vehicles, and again precautions must be exercised in loading to facilitate quick delivery. Parcels for the nearest points on the carter's round must be placed where they will be readily accessible at the back of the van, and vice versa.

A brief survey of the working of the two sections of the warehouse in conjunction shows the smoothness of the system. As the road vehicles are unloaded they pass round to the "inward" section of the warehouse in readiness to receive a load from an incoming wagon, and as the incoming wagons are unloaded they are withdrawn from the "inward" side and shunted to the "outward" side of the warehouse in readiness to receive more traffic.

In our review of the goods warehouse we have dealt only with complete van loads consigned to special destinations and routes. It must not be assumed, however, that in every case each item of traffic loaded into a particular wagon is destined for the same town, and that on arrival at that town the traffic can be dealt with in the "inward" section in the manner we have just described. A moment's thought will show how impossible this is.

A busy goods station will receive traffic for thousands of destinations each day. For only a few of those destination stations is it possible to make up full van loads, yet economical working demands that each wagon despatched must be filled. Obviously then the solution is to combine the small items of traffic and forward them in one wagon to some intermediate point where they can be sorted and combined with traffic from other parts of the country, and re-forwarded to their individual destinations. This traffic is known as "trans-ship," and at many big depots special "trans-ship" sheds are provided to handle it. As a general rule, however, it is more advantageous to bring the "trans-ship" vans into a goods depot such as we have described, and to re-sort there. The probabilities are that the "trans-ship" traffic, when combined with new traffic at the depot, may be sufficient to justify the use of a wagon for its individual destination.

Out in the goods yard itself other wagons are being loaded with bulkier traffic, usually calling for the sole use of a wagon. This is what is known as "station to station" traffic; that is, it is delivered to the railway by the consignor and collected from the company by the consignee. As the wagons are filled here they are attached to the wagons that have come from the warehouse and are ready for despatch.

From the goods depot the first stage of the loaded wagons' journey is to the nearest sorting sidings or marshalling yard. In the case of a local junction this will be quite a small place of the "flat yard" type, in which all shunting is done by engine power. At the more important depots, where thousands of wagons are dealt with each day, a system requiring only the services of one or two small

tank engines and one big shunting engine is employed. Such yards are known as "gravitation yards" and "hump yards," and the weight of the wagons themselves is the principal source of the power employed in sorting them. The newly-loaded train of wagons as it leaves the goods yard probably will consist of about 20 to 25 wagons, and possibly no two of these are for the same destination. The shunter's task is to separate these wagons one from another and work them into position with other wagons for the same destination that are waiting ready on one of the sidings, until eventually a complete train for one route is made up ready for despatch. Little shunting tanks known as "trip engines" are employed to haul the wagons from the goods yard to the marshalling yard, and it is an amazing sight to see one of these diminutive "maids-of-all-work" couple up to some 250 to 300 tons of traffic and haul it merrily away.

On arrival at the reception sidings in the marshalling yard, the trip engine uncouples and steams away, leaving its train of wagons for the attention of a huge shunting engine. Numerous varieties of these engines are is use. The 0–8–4 and 0–8–2 tanks of the L.M.S.R. are well known, both these types being built at Crewe, though there were formerly a few L. & Y. section 0–8–2 tanks of Horwich design. There are several enormous 0–8–4 tank locomotives employed at Wath on the L.N.E.R. These are three-cylinder engines of great power and belonged to the Great Central Railway. Engines of the reverse wheel arrangement, 4–8–0, also with three cylinders, were built by the North Eastern Railway, and some are now used at March for shunting ou the hump there. This type is found also on the Southern Railway, having been introduced on the L.S.W.R., more particularly for marshalling work at Feltham. On this system the latest pattern of shunting engine is shown by the illustration on page 544, the engine being of the 0–8–0 type with three cylinders. There are also tank engines having the same arrangement of wheels on the Caledonian section of the L.M.S.R., but these have two inside cylinders only. The use of three cylinders in locomotives intended for such services is especially valuable in securing a powerful and even turning movement at slow speeds.

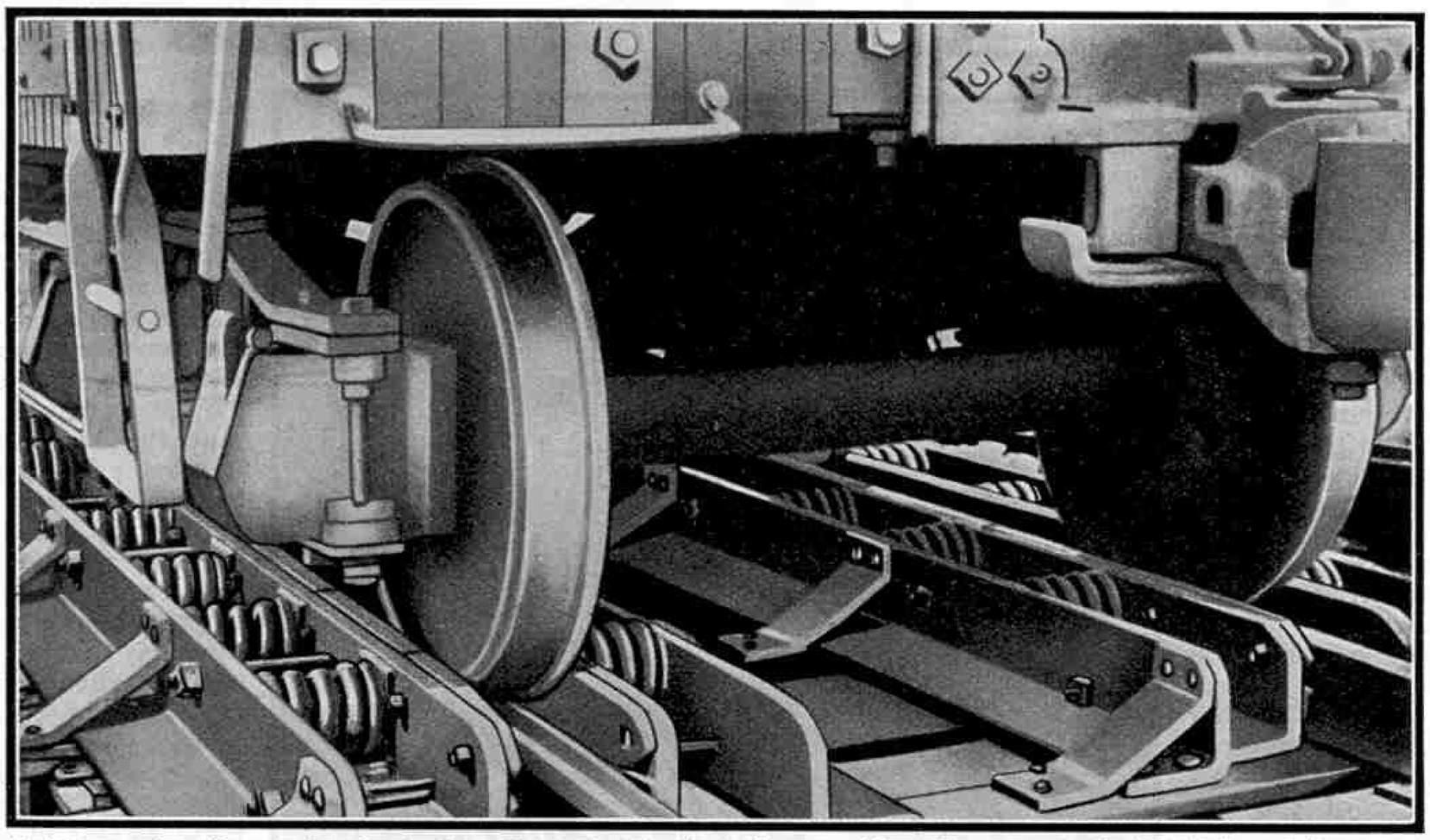
The accompanying illustration gives an excellent impression of a typical "hump" shunting yard and the arrangement of the various sidings, which can be seen radiating from the main roads leading from the hump. At the hump itself it will be noted how steeply the incline dips immediately below the crest. That sharp dip is to provide the wagons coming over the top with sufficient impetus rapidly to draw clear of the wagons immediately following, thus giving the signalman controlling the points sufficient time to switch each wagon into its own siding and to clear the points again before the next one comes along.

While the hump engine is backing up behind the train, the shunters examine the destination label on each wagon. It is their task to chalk on the sides of the wagons in large figures the number of the special road on to which the individual wagon is to be shunted, and as each one is numbered it is uncoupled from the wagons immediately preceding and following, unless they also are going into the same siding.

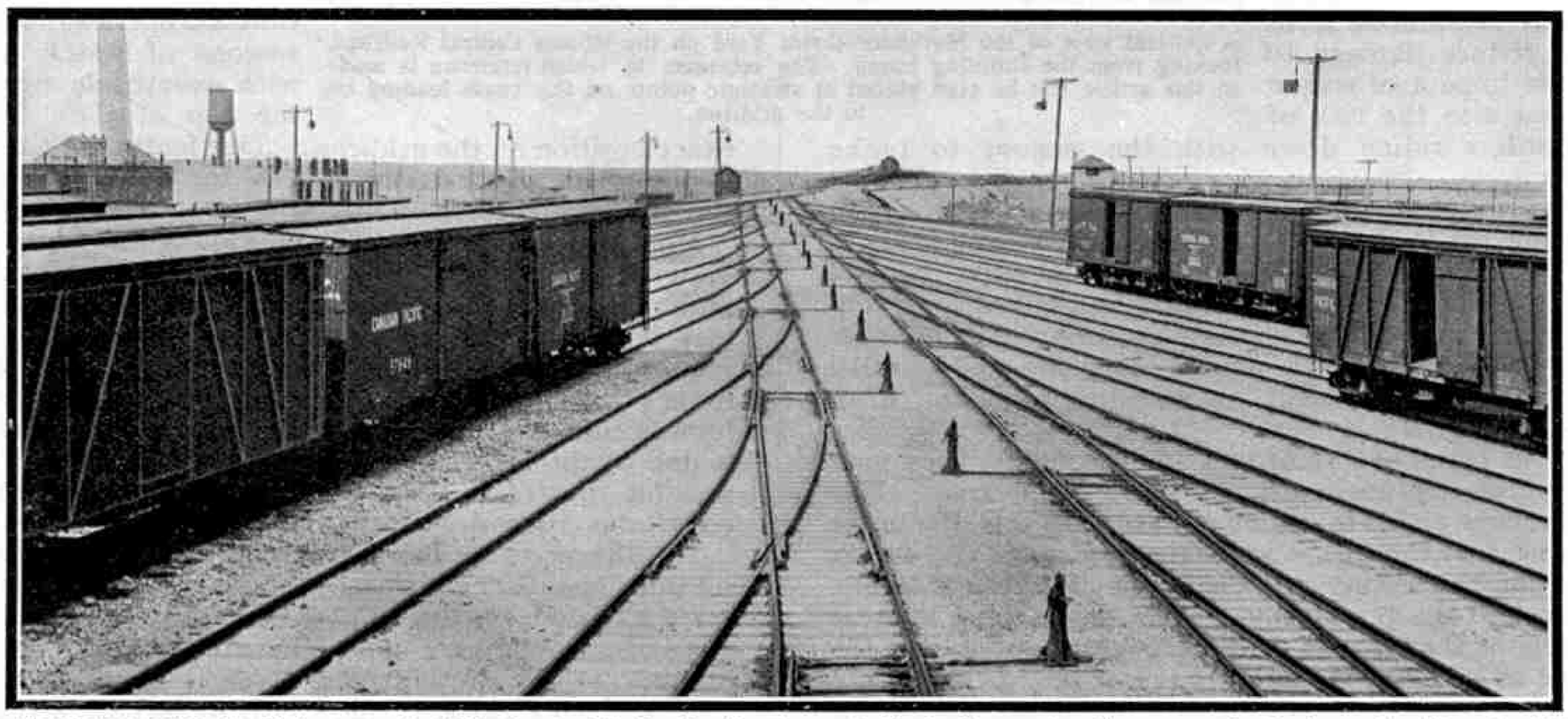
As soon as all is ready the hump engine pushes the long train slowly but steadily toward the summit of the hump. Here it will be noticed a signal cabin is located. As the first wagon approaches the top the speed becomes slower and slower until it is barely a mile an hour when the top is reached. Then the engine shuts off steam, and over the top and down the sharp grade of the long incline into the marshalling yard goes the first of the wagons. As each wagon passes the signal box the signalman observes the number on its side and sets his points accordingly.

As the wagon goes through on to its correct siding on the "gridiron," as the arrangement of roads in the marshalling yard is termed, the brakes are jammed on by a shunter who rides down the siding with the wagon, and gradually the wagon comes to rest and merely awaits coupling up to make it a link in the line of a new complete goods train. Wagon after wagon follows over the incline until the whole of the hump engine's load has vanished. But in the meantime another train of wagons has come from the goods yard, and so the process is repeated over and over again until each siding contains a long train that awaits only the addition of a brake van and a locomotive before it steams away to its own destination at its appointed time.

The shunting system adopted in a "gravitation" yard differs somewhat from the "humping" process. As the name suggests, the whole operation is carried out by the force of gravity acting upon the train of wagons brought from the goods depot. The yard slopes gently from the reception siding or road on to the "gridiron," the gradients varying from 1 in 60 to 1 in 100, according to the distance to be covered. As each train is brought on to the reception road and made ready, the trip engine uncouples and allows the



A close-up view of a retarder, showing how the wagon wheels are "squeezed" as they run over the installation. This system of shunting control is adopted at the L.N.E.R. Marshalling Yard at March, Lincolnshire.



The Canadian Pacific Railway yard at Winnipeg, with the shunting hump in the background. The reason for the term "gridiron" will be apparent from the arrangement of the sorting roads. The sharp fall immediately below the hump gives a good impetus to the vehicles.

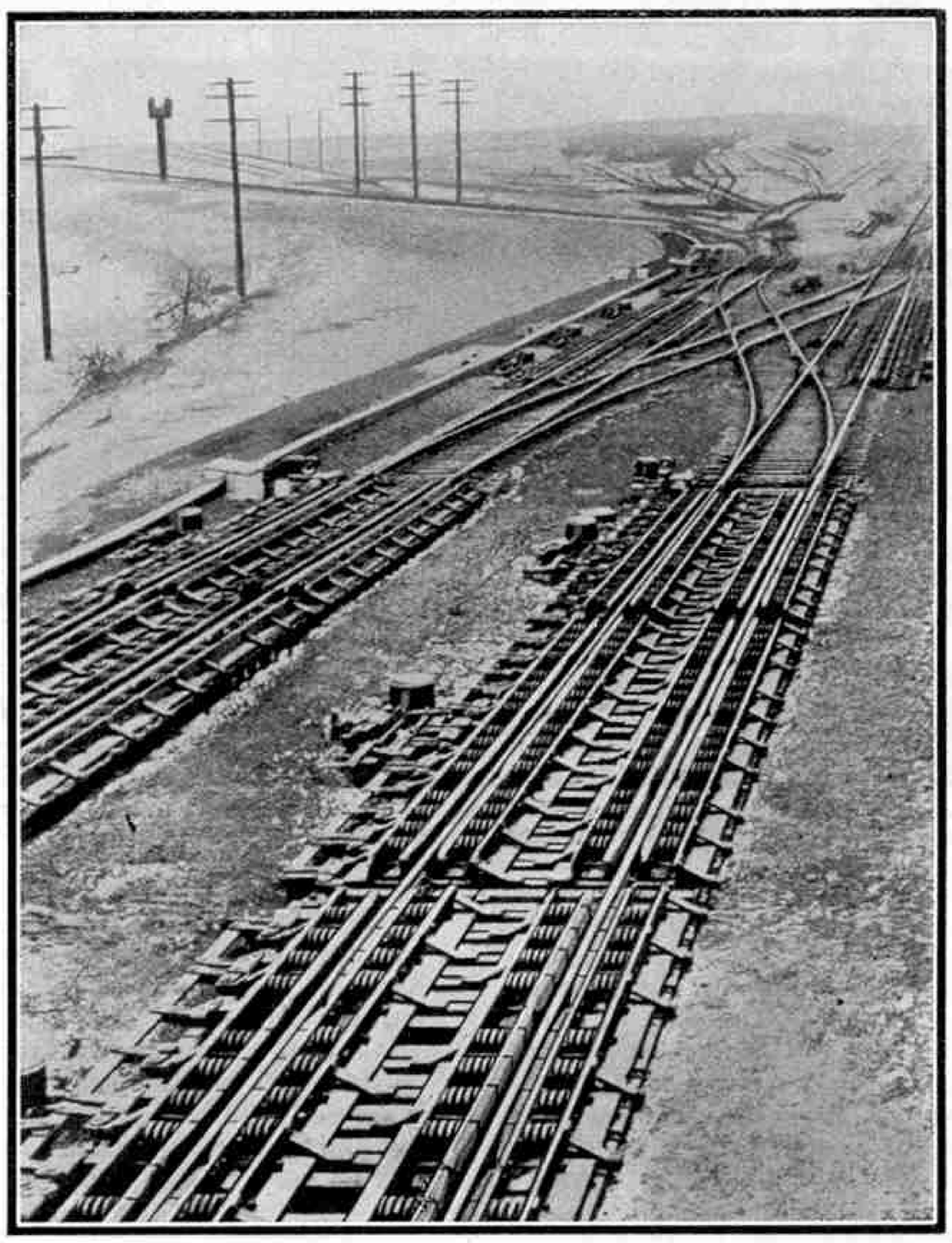
wagons to run back down the track toward the sorting sidings. From this point onward the system is precisely the same as that in a "hump" shunting yard, that is, the wagons are switched into their respective sidings by a signalman, who takes his instructions from the numbers chalked on them.

A typical gravitation yard is that at Edge Hill, Liverpool, on the L.M.S. Railway, and here large numbers of wagons are handled every 24 hours. At the height of the busiest period trains of wagons and trucks are passing up from the goods depot to the marshalling yard every five minutes, and throughout the night the whole of the 60 acres covered by the "gridiron" resounds with the clang, clang, clang of buffer meeting buffer as wagons are shunted into position.

It is necessary sometimes to vary slightly the procedure we have just described. If it is dark, for example, the chalk marks on the wagons cannot easily be seen by the signalman, and then the foreman shunter directs the signalman into which sidings the wagons are to be switched by means of a code of signals blown on his whistle. On some railways it is the practice not to chalk on the sides of the wagons the numbers of the sidings into which they are to go, but to chalk on the front of the first wagon its own number, and on the rear of each wagon the number of the siding into which the next wagon or batch of wagons is to be shunted. Thus, after the first wagon has been dealt with, the signalman does not need to pay any further attention to the approaching wagons and has only to observe the number chalked on the back of the one that has just passed.

As each complete train is made up in the sorting sidings a brake van is shunted into position and a locomotive quietly takes its place at the head of the train. There is a shrill shriek of a whistle, and away steams the train on its long journey. A few minutes later the siding it has just vacated is being filled again.

The operation of any shunting yard obviously demands the exercise of considerable care in order to avoid mishaps, and various safety devices have been introduced from time to time to reduce damage to traffic through the impact of wagon against wagon, and also the risk of accidents to shunters riding down with the wagons to brake them into position.



A general view of the Markham Goods Yard on the Illinois Central Railroad, looking from the shunting hump. The retarders to which reference is made in this article can be seen placed at strategic points on the roads leading on to the gridiron.

Among the many safety appliances that have been invented for use in shunting yards, the most important of recent years is probably the "retarder," a device that gives positive control over each truck from the moment it leaves the summit of the hump until it is brought to rest in its appropriate position. The retarder is an arrangement of brake shoes placed alongside and parallel to the running rails, and its effect, as its name indicates, is to reduce the speed of the wagon.

There are various types of "retarders," but, roughly, they may be classified as "electro-pneumatic" and "all-electric." The former is the older type and is in commoner use. In this, the brake shoes are forced against the inside and outside faces of the wagon wheels by compressed air acting on a piston which, through levers, transmits the force to the brake shoes. The brake shoes squeeze against the wheels of the wagons that are being shunted, and the effect is the same as if either the hand brake or the air brake had been applied. The admission and the release of the air in the cylinders governing the brake shoes, and the exact pressure to be exerted by the shoes, are regulated electrically by signalmen working in a control tower overlooking the hump and gridiron. In the all-electric types the action of the shoes is electrically governed throughout from a similar control tower.

The control apparatus is constructed so that as many as five different pressures may be applied to the operating cylinder. These available ranges of pressure give absolute control over wagons of different weights moving at different speeds. For example, it is frequently necessary to "hump" two wagons coupled together, one of which may be loaded and the other light. In order to obtain the proper retardation effect different pressures must be applied to the two wagons. This is done quite easily. Assuming that the light wagon goes over the hump first, the operator, awaiting this movement, will set up a low pressure to hold until the light wagon has cleared the retarder, when he can immediately apply a higher pressure to compensate for the loaded wagon.

Although the absence of an extensive air compression plant and lengthy ducts is a big point in favour of the all-electric system, there are several big advantages claimed for the electro-pneumatic apparatus. First of all, the mechanism by means of which it is worked is extremely simple, being merely a compressed air cylinder and piston actuating a simple arrangement of levers and bell cranks so as to bring about the lateral movement of the retarder shoes. The effect is to make braking very smooth and yet continuous. It has a distinct cushioning effect, and all abnormal stresses are absorbed by the air cushion of the operating piston.

The position in which retarders are placed has to be studied carefully and can only be determined upon by someone who has an intimate knowledge of the yards or of the "hump" in question. Let us suppose that the hump over which an 8-coupled engine recently shunted a train of wagons is a hump fitted with retarders. The operations would follow generally the system that has already been described, but each individual wagon would come under the survey of the control tower from the moment it left the hump until it was brought to a standstill in its correct position. The signalman in the tower notes beforehand the destination siding and the approximate weight of each wagon, and is able from his experience to decide the extent to which he must apply the retarder units over which the wagons pass on their way down the gradient. At the same time he switches the wagons towards their destination track. On the way down the line more retarders are brought into operation, and finally the wagons are slowed down so much that when they reach those that have preceded them the impact is scarcely discernible. The apparatus works so accurately that the operators are able to control wagons of widely varying weights with exactitude right through from the top of the "hump" to their exact position on the gridiron. This feature of the retarder system is one of its greatest advantages, for the risk of damage both to the trucks and their contents is entirely eliminated.

More important still is the abolition of the wagon rider under this system. As we have already explained, the braking of wagons under the old system is carried out by hand, and to accomplish this task it is necessary for a shunter to run and ride down with the wagon for a certain part of its journey at least, until the wagon brakes come into action. Necessarily risks are taken, and although fatal accidents are comparatively rare, that happy state of affairs is due to the agility of the shunters. Further, it has been found possible to operate a retarder-controlled shunting yard in weather conditions that would effectually stop ordinary shunting work.

We illustrate a portion of the Union electro-pneumatic car-retarder installation fitted in the Markham Goods Yards at Hazlecrest, Chicago, on the Illinois Central Railroad. This illustration gives also a good view of a hump shunting yard as viewed from the hump. At the present time there is only one retarder-operated yard in Great Britain, the L.N.E.R. having installed the system at their yard at March in Lincolnshire. This yard is over a mile in length and has room for some 4,000 wagons. There are 10 reception roads, 40 sorting sidings, and four retarders. Seven points are automatic, and their movements in the correct sequence are set in advance by the operator at the switch table in the control tower or cabin. Each of these points controls the entry of wagons into one of eight groups of sidings consisting of four tracks each. This yard is thoroughly modern in all respects, and representatives of railways in other countries have been favourably impressed with the rapidity and efficiency of operations carried out there.

A very interesting labour-saving device known as the "traverser" is employed in certain of the busiest

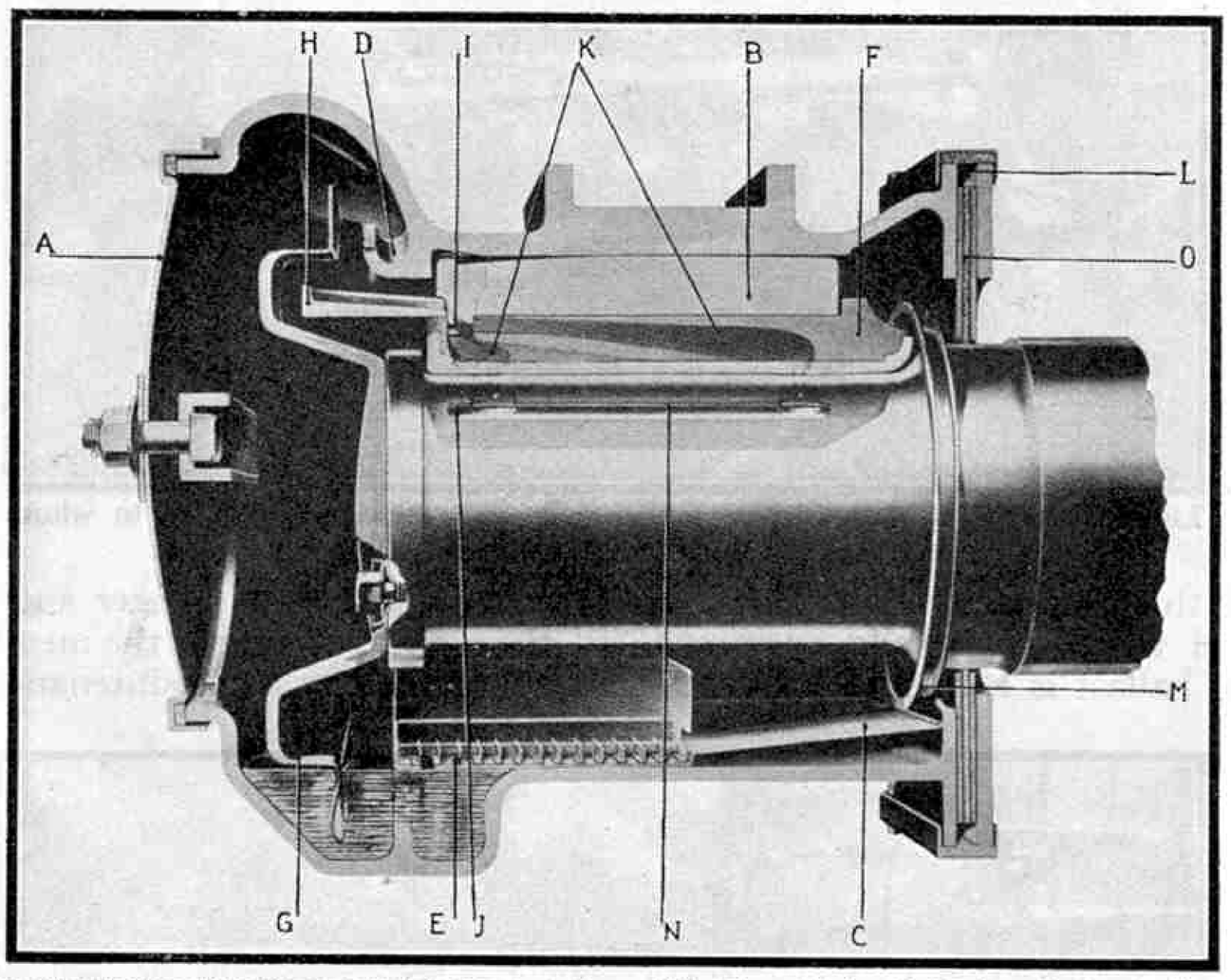
(*Continued on page 549*)

Improvements in Rolling Stock Bearings

The "Isothermos" Axle-Box

DURING the century of existence of our railways, improvements have been made that would have amazed the pioneers of the iron road. The power of present-day locomotives, and the huge loads they haul, are in striking contrast to the primitive engines of the days of Stephenson; and the improvement in passenger rolling stock is equally remarkable. Certain details and fittings, however, show comparatively little change, either because the same types have proved satisfactory through the years, or that no types showing marked superiority have been devised. For example, axle-boxes and bearings generally, although roller bearings have been applied to some extent, have advanced very little in design, apart from the increased dimensions made necessary in order to support progressive increases in axle loads, and the more extensive use of oil-lubricated axle-boxes in place of the grease-boxes previously in favour for ordinary rolling stock.

In recent years experiments have been carried out with the object of perfecting a type of oil axle-box capable of fulfilling the most exacting conditions of service, and of withstanding wide differences of temperature with the minimum of attention. For an axle-box to operate effectively it is necessary for it to fulfil certain definite conditions. The supply of oil must be regulated in accordance with the speed of the vehicle, and there must be no loss of oil. It is also important that no loose parts subject to wear should be incorporated, and no adjustments required during the life of the bearing. Many attempts have been made to evolve new systems of effective and economical lubrication of journals, but up to the present the only devices that have been at all successful have been very costly.



Sectional View of "Isothermos" Axle-Box: A, Pressed Steel Cover Plate; B, Wedge; C, Tray leading to Oil Purifier; D, Oil Collecting Grooves in Body; E, Oil Purifying Device; F, Bearing Bush; G, Revolving Oil Dipper or Palette; H, Oil Catchment Tray on Wedge; I, Oil Port in Wedge; J, Longitudinal Oil Grooves in Bearing; K, Oil Feeding Grooves in Bearing; L, Dust Guard Housing; M, Oil Retaining Ring; N, Dripping edge of Oil Groove; O, Dust Guard.

An interesting solution of this problem is provided by the "Isothermos" axle-box. This involves only a small increase in initial cost, and its success in meeting the necessary conditions may be judged from the fact that there are now over 200,000 in regular service on railways operating in every extreme of climatic conditions throughout the world.

The accompanying illustration makes clear the main features of the box. On the end of the axle and rigidly secured to it is a dipper or palette G, which, as the axle revolves, picks up oil from the reservoir and carries it to the upper part of the box. The oil leaves the palette by centrifugal force, or by drip. The oil that leaves by centrifugal force is flung against the upper walls of the box, from which there is an abundant flow to the central collecting channel D. From this channel the oil is led by one or more openings to the feeding tray H of the wedge block B, or of the bush itself if no wedge is provided. The oil that is not flung from the palette by centrifugal force drips by gravity from its two extremities, one of which has a segmental form specially designed to allow the oil ample time to free itself during its passage over the feeding tray H. From this tray the oil passes along a series of channels I, J and K in the upper part of the bush F, and is distributed over the journal.

Oil that tends to escape along the axle at the rear of the bearing is picked up by a special form of oil-retaining ring M, and is either flung off at high speeds or drips off at low speeds; and the box at this point is so designed that the tendency of this oil is always to flow towards the reservoir, from which it is again passed into circulation.

Where the boxes are intended for specially high-speed rolling stock a filtering or purifying device is fitted in the box. The oil dripping from both sides of the bush F along its entire length falls into two outer filtering trays E, where any grit will settle in the partitions as the oil passes along on its return to the reservoir. The drip from the oil-retaining ring and the return flow from the rear end of the bush are dealt with differently, as there is a greater possibility of this oil containing particles of foreign matter. This oil is collected by the sloping surface C, and fed through a central filter tray E on its way to the reservoir. This filter tray is provided with a cover, because when the axle ceases to revolve, a large quantity of the oil held in suspension falls suddenly on to the filter. The effect of this would be to disturb any impurities collected in the tray and to carry them through to the reservoir if the tray were not so protected.

The "Isothermos" system not only lubricates, but also cools. The flow of oil is so copious—from 30 lb. to 40 lb. per hour at the higher speeds—that the temperature of journals on high-speed long-distance trains does not greatly exceed that of the human body, feeling no more than warm to the touch. Special measures have been taken to ensure that there shall be no critical speed at which oil is neither flung off the palette by centrifugal force, nor unable to drip by reason of such force.

It is claimed that the "Isothermos" box will give 100,000 miles of service without refilling or attention of any kind. The practice of returning rolling stock to depots for attention to bearings is dispensed with, and bearings are inspected only when the vehicles are called in for periodical general overhaul. Experience has been gained in both tropical and arctic climates. "Isothermos" boxes covered with ice at 30 degrees below zero have operated quite satisfactorily, just as have boxes working in Equatorial Africa. In hot sandy areas they are particularly successful on account of the effective sealing against the entry of grit, and the cooling action of the copious oil flow.

For India and other countries where thefts of oil from axle-boxes are prevalent, and skilled labour is scarce, a special box of simplified construction is being prepared. This box is absolutely thief-proof and perfectly secure from interference by any but authorised persons.

The question has been raised as to what would occur if a vehicle were left standing for a considerable period and then moved for a long distance at a slow speed. It has been found that the large quantity of oil retained between the bush and the journal is more than sufficient for full lubrication at the moment of starting, while active lubrication by drip appears as soon as the vehicle is moved.

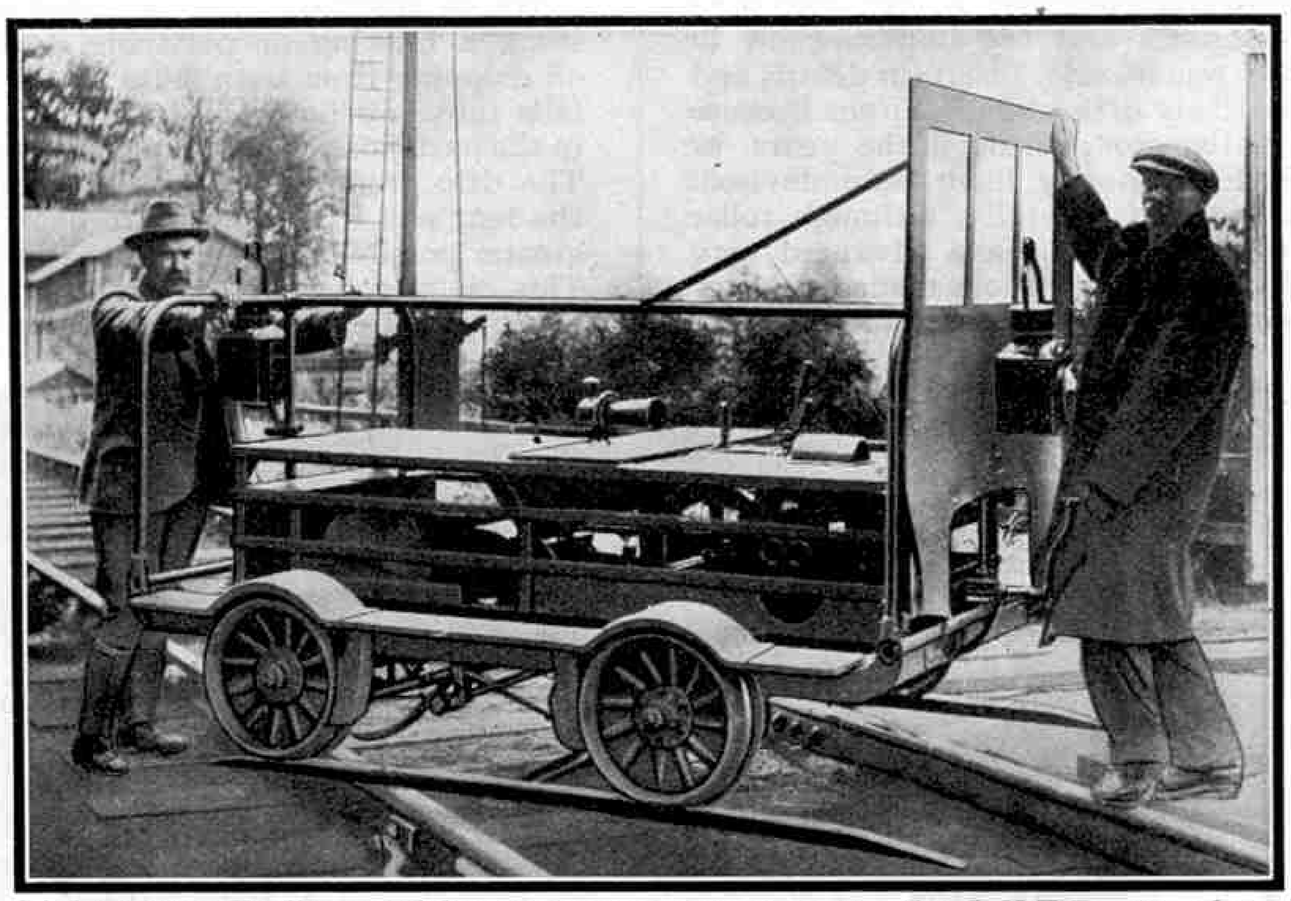
It is interesting to note that a special type of "Isothermos" axle-box is available for vehicles that are subject to tippling. This box can be completely reversed in any direction without loss of oil.

Portable Turntables for Rail Motor Trollies

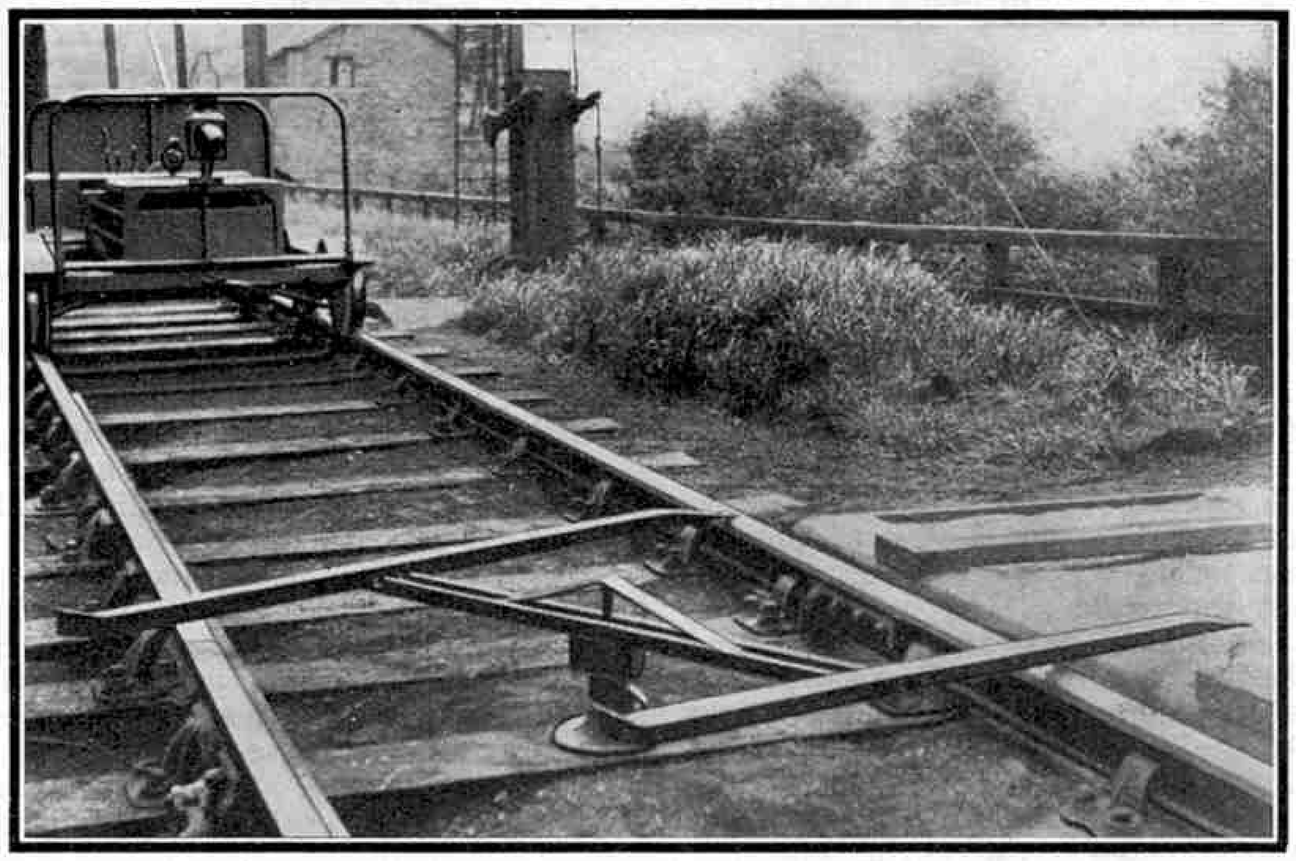
Quick Transport for L.N.E.R. Permanent Way Men

AN important branch of the work of the railway engineer that does not always receive the attention it deserves is the provision and maintenance of a good permanent way. Without a satisfactory road bed it would be quite useless to build giant locomotives or comfortable rolling stock, for high speeds would be impossible and the discomforts of a journey over a rough and irregular track would not be overcome by the best springs and cushions ever made.

The road beds of British railways are famous for their smoothness, and to them must be given a large share of the credit for the wonderfully fast runs made by trains on the main lines of the four great railway groups of this country. Every inch of the thousands of miles of track is carefully examined at regular intervals. The ballast is kept in good order, and sleepers, chairs, and rails are repaired or renewed when necessary. In addition, the engineers responsible for the permanent way are keenly alive to possible improvements, and are constantly trying new methods of laying down satisfactory road beds, or better means of keeping them in first-class condition. For instance, in the course of last year each of the four groups has introduced the use of steel sleepers. These have been laid down on certain lengths of track, and their capacity for standing up to the heavy duties imposed on them is being carefully watched.



Light Motor Trolley used by permanent way men on the L.N.E.R., to whom we are indebted for the photographs illustrating this article.



The portable turntable used when running the L.N.E.R. motor trolley on its siding or replacing it on the track.

Equally interesting experiments are being made for the purpose of enabling the platelaying gangs to carry out repair work more efficiently and thoroughly. One of the most interesting of these is being carried out on the Nidd Valley Railway, a branch of the L.N.E.R. that connects Pateley Bridge with Ripley Valley Junction, on the main line from Leeds and Harrogate to Thirsk and the North. This is a single line, 11½ miles in length, that is worked on the electric tablet system. A train is not allowed to enter a section unless the driver is in possession of a tablet that can only be withdrawn from the signalling instrument and given to him when the way is clear. On leaving the section the driver gives up the tablet to the next signalman, and until it has been inserted by him in the instrument in his box, no other train can be given the signal to enter the section.

Until recently the Nidd Valley line was divided into four portions, each of which was examined and kept in condition by a ganger and two platelayers. Under the new arrangement the men form a single gang and are responsible for the maintenance of the whole of the track. In order to enable them to move quickly along the track from point to point motor trolleys of a very interesting type have been designed. These run on the track itself and there are two of them, one being stationed at each end of the line. Each weighs about 15 cwt. and is capable of carrying from eight to ten men. They travel at a speed of 25 miles per hour.

In designing the vehicles it was necessary to provide means for removing them easily from the track on arrival at the point at which the men are to work. The problem has been solved by the introduction of a very ingenious portable turntable. This is carried on the trolley itself and is so light that it may be easily handled and used by one man. It consists of two short lengths of rail connected by a cross piece hinged at its centre. The gauge of the turntable is exactly the same as that of the track,

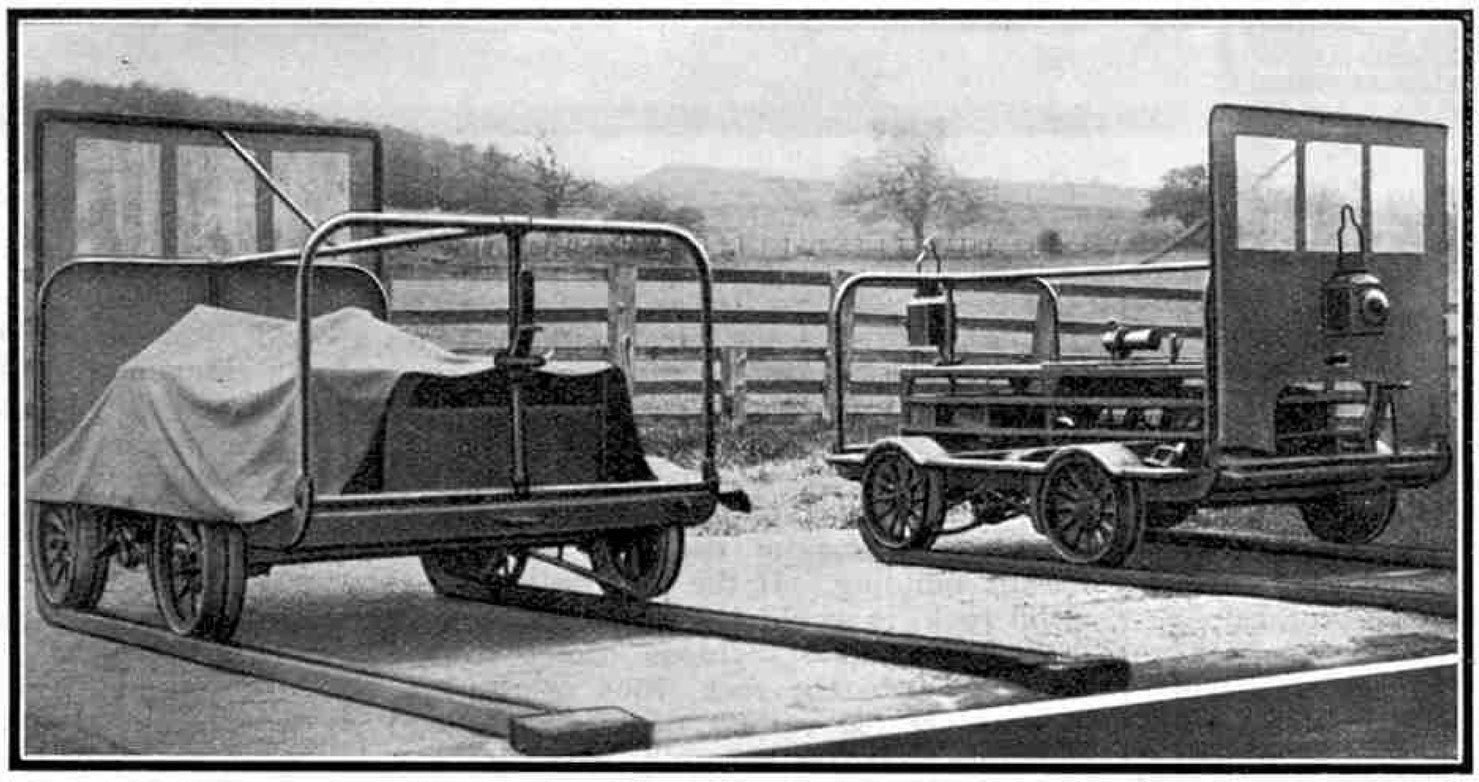
of course, and the short rails fit on those of the permanent way when the support is placed centrally on the track.

In order to remove a trolley from the line it is pushed on to the turntable, tiny ramps at the ends of the short rail lengths being provided to enable this to be done. When balanced, the turntable is swung round until its rails are at right angles to those of the track, and the trolley may then be pushed off. This is only done at points where rails have been laid down on to which the trolley may be run in order to be out of the way of passing trains. These small sidings have been constructed at intervals of three-quarters of a mile, and trolleys standing on them may readily be replaced on the track by means of the turntable.

On commencing the day's work the trolley at each end of the branch is run on to the track and the ganger or man in charge then tells the signalman where he wishes to go. If the line is clear the signalman takes out a key from the electric tablet instrument. This breaks down the electric tablet working by means of which ordinary traffic is controlled and while it is in the possession of the ganger it is impossible for the signalman to withdraw the tablet that allows a train to pass his box.

The trolley then may be run to the point where work is to be carried on without fear of collision with trains on the line. On arrival it is switched into the nearest small siding and the ganger then inserts the key in a keybox standing near. This action informs the signalman that the line is clear and he is then able to switch into circuit the electric tablet instrument and to resume ordinary working. When this has been done the ganger is unable to withdraw the key without permission from the signalman.

At the end of the day's work, or when it becomes necessary to move on to a new place, the ganger telephones for permission to remove the key. If the signalman thinks that the presence of the trolley on the track will not interfere with the normal service of trains he switches the electric tablet instrument out of the circuit, and the word "free" appears on a disc in the keybox. The ganger then withdraws the key and proceeds to put the trolley on the line, knowing that the track is clear and that no train can enter his section until he has again given up the key.



Two L.N.E.R. motor trollies in the sidings provided for them. As our photograph shows, the sidings are very simply constructed.

The trolleys are employed for carrying the working gangs and their tools to any place where repairs or renewals are required. Only one other man is required in the scheme. He is known as the "Track Walker" and his duty is to travel over the whole length of the line each day and to key up, inspect and oil the points. In addition, he must report any exceptional circumstances to the main gang in order that defects may be remedied without delay.

The motor trolleys are employed to carry permanent way men on the Hawes branch of the L.N.E.R. as well as on the Nidd Valley line, and it is expected that the scheme will be extended to other parts of the system.

Exploring the Antarctic—(*Cont. from page 532*)

and sent to North Russia, where, with the assistance of old comrades of the "*Endurance*," he gave advice and expert assistance in regard to the equipment of the troops operating in the Arctic climate of Archangel and the Murman Coast. It is interesting to learn that the troops operating in that region were clothed and fed in almost exactly the same manner as the men who under Shackleton's lead had accomplished such great work in the Antarctic.

At the close of the War Sir Ernest's active mind naturally turned again to exploration. His first idea was to lead an expedition to penetrate into the Beaufort Sea, the vast frozen area north of Alaska that had so far baffled explorers. In preparation for this he bought a Norwegian whaler to which he gave the name "*Quest.*" Difficulties arose and finally it was settled that Sir Ernest should take the "*Quest*" south in order to explore the coast line of the Antarctic continent from the Weddell Sea to Enderby Land, south of Africa. With him went Frank Wild and many of his old comrades of the "*Endurance.*"

The real work of the expedition began when Shackleton left South Georgia in the "*Quest*" and sailed toward Coats Land, at the western end of the stretch of coast he intended to explore. But Sir Ernest himself was destined to take no share in it, for the voyage had scarcely begun when a sudden heart attack brought his amazing career to an end. The vessel returned to South Georgia, and in that island, the scene of one of his greatest exploits, this Antarctic hero was buried.

We are indebted to Lady Shackleton for the portrait of Sir Ernest Shackleton on page 530, and also for permission to reproduce the photographs taken on the "*Endurance*" expedition, which were kindly supplied by the Royal Geographical Society.

The Working of a Goods Yard—

(*Continued from page 546*)

stations. Occasionally it is desired to move a wagon from its position on one set of lines into a position on another line, possibly on the further side of the depot. In the ordinary way this would necessitate probably the shunting, not only of the wagon immediately concerned, but also of many others, and half a dozen movements easily might be involved. The traverser avoids all this, for it is a section of standard track mounted on an electrically driven platform that can be moved sideways along a special runway and placed in alignment with any set of rails in the depot. When it is desired to move a wagon from its position alongside the loading platform, it is placed in position on the traverser, which is then moved across the depot until it comes into alignment with the particular track on to which the wagon is to be placed. This system is very economical, for it saves time, engine power and disturbance to other traffic.

Among other mechanical devices reference must be made to the endless belt conveyor. There is no better illustration of the labour-saving value of this equipment than the L.M.S.R. docks at Garston on the Mersey. Here a considerable portion of the banana import traffic is handled, the incoming ships being met by trains of special banana vans ready for despatch to all parts of the country as soon as they are loaded.

The unloading of each ship is carried out entirely by conveyors, one set working between the ship's hold and the quayside, and another along the quay parallel with the waiting train. The belt working up from the hold is spaced at equal distances with trays that hold the great bunches of fruit as they are placed in position at the loading point. The belt passes up through the hatchway, over the ship's side and on to the quay. There the fruit is discharged on to the second conveyor, and as this moves along, the bunches of fruit are lifted clear by porters and placed in the vans.

ENGINEERING NEWS

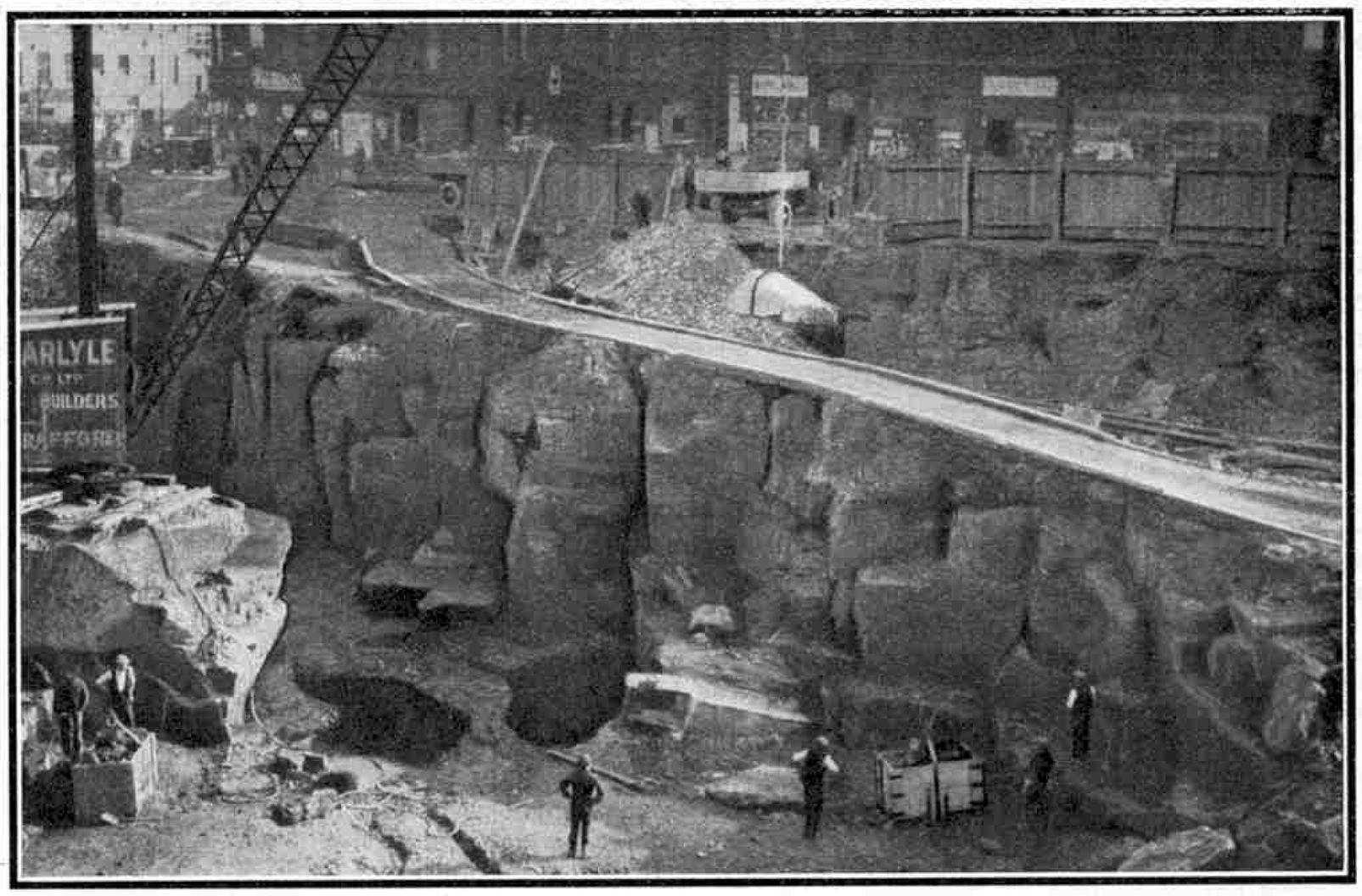
New Store Building in Leeds

Work on the big new store to be erected in The Headrow, Leeds, for Messrs. Lewis's Ltd., the well-known British multiple firm, is progressing rapidly. The building is being erected on a site of about 6,000 square yards and will comprise five floors, two of which are below the ground. Provision is being made for extension upward, however, when the present roof will become the fourth of the nine floors of the complete building. The total floor area will then be nearly 500,000 sq. ft., and about 5,000 tons of British steel will have been incorporated in the structure.

The lower of the two floors below ground level will be devoted to the mechanical needs of the building and will be equipped with boilers and allied plant, an electric sub-station and a switch room, mechanics' shops, ventilation fans and ducts, and the receiving end of the pneumatic cash system. Escalators will be installed in the building in order to serve the busiest floors, whilst the requirements of the entire structure will be met by two banks of lifts.

The excavation work necessary is now practically complete, nearly 95,000 c. yds. of spoil having been removed. Work was carried on continuously, light being provided at night by means of powerful flood lights. Two Ruston-Bucyrus navvies were first used, these tipping direct into six-ton motor lorries at the rate of 600 c. yds. per day. Sandstone was encountered 10 ft. below the surface, however, and it then became necessary to employ pneumatic drills, sledge hammers, quarry wedges, and crow bars. For removing the spoil four derricks with jibs 90 ft. in length were erected in positions that enabled every portion of the site to be reached. The broken rock was dropped into wooden skips that were hoisted out of the excavation and emptied into lorries waiting alongside the site. In certain instances huge blocks of stone weighing up to five tons were lifted out bodily. The seam of rock was about 25 ft. in thickness. Below it was loose shale and in removing this the mechanical navvies again could be used.

As shale forms the bottom of the required hole, it will be necessary to build the entire structure on a concrete raft. In this will be set the steel grillages forming the foundations for the steel framework of the building. If the bottom had been solid rock, it would have been possible to bolt the steel stanchions direct to rag bolts let into the rock, thus resulting in a considerable saving of steelwork and concrete. Water naturally found its way into the excavation, and this was dealt with efficiently by means of direct-coupled electric centrifugal pumps discharging directly into the street sewer.



Preparing the foundation of the new store now being erected at Leeds for Lewis's Ltd., to whom we are indebted for our photograph. How the necessary excavation work was carried out is explained on this page.

Motor Launch of Aluminium Alloy

An interesting motor launch constructed by the Birmingham Aluminium Casting Co. Ltd. is made of a new alloy called Birmabright that is not corroded by sea water.

"Miss Birmabright" is the name given to the vessel. She is 22 ft. in length between perpendiculars and has a beam of 6 ft., a depth of 3 ft., and a draft of 1 ft. 9 in. A Morris-Commodore engine developing from 18 h.p. to 50 h.p. is fitted and accommodation for ten passengers is provided.

Progress of Britain's Giant Liner

The giant liner now being constructed by John Brown & Co. Ltd., Clydebank, for the Cunard Steamship Company will be launched in February, 1932, instead of in the following June, as previously announced.

The liner will be 1,018 ft. in length and will have a beam of 115 ft. Her gross tonnage will be 75,000, and she is expected to have a speed of at least 30 knots. It is now settled that she will have eight decks above the waterline. The boat deck will be 650 ft. in length and will be at a height of no less than 70 ft. above the load line, while the length of the promenade deck will be more than 720 ft. Three funnels will be fitted. These will be 40 ft. in width and will tower to a height of 130 ft. above the waterline.

World's Non-Stop Motor Record

Two Americans recently set up a world's record by driving a Ford model 'A' continuously for 2,775 hrs. 46 mins. or practically four months. During that time the car ran 47,138.3 miles.

In the course of the long journey, which was carried on regardless of weather and road conditions, punctures made it necessary to change tyres eleven times. Even this was done without stopping either the engine or the car, a travelling jack being used in order to enable the wheel requiring a new tyre to be taken off by one of the drivers running by the side of the car as it moved slowly along. Apart from tyre changes the only repairs necessary throughout the run were the replacement of the sparking plugs after covering 30,000 miles, the fitting of new generator brushes and the renewal of a single nut.

The equipment carried during the long and monotonous journey included a folding bed on which the drivers rested in turn and a wireless receiving set. For the greater part of the run neither of the drivers left the car except when changing wheels.

Diversion Tunnel Cut in Solid Granite

In Washington, in the United States, work is now proceeding on the second instalment of a gigantic scheme for the supply of hydro-electric power to the city of Seattle. The source of power is the Skagit River, which is only 125 miles in length but drains a very large area and is subject to torrential floods. The river has been known to rise 22 ft. in the course of 10 hours, and the rate of flow of the water varies from 470 c. ft. per second to 100,000 c. ft. per second.

The first part of the scheme came into operation in August, 1924, and the output from this portion is now 75,000 h.p. A new dam has been constructed higher up stream, and the power house to be operated by the water impounded is now rapidly approaching completion. This is being erected at Reflector Bar, a few miles below the dam, and it is expected that two 95,000 h.p. generating units will be installed in it this year.

The Diablo Dam, as the new retaining work is called, is 389 ft. in height, and 1,180 ft. in length on the crest. Its width varies from 140 ft. at the base to 16 ft. at its highest point, and about 350,000 c. yds. of concrete were used in its construction. It is situated at a point where the river has cut a deep gorge through solid granite. Before it could be built the course of the river had to be altered. For this purpose a diversion tunnel 20 ft. in diameter and 650 ft. in length was cut through solid rock from a point 250 ft. above the dam, and the water was directed into it by means of a temporary obstruction of fir logs weighted with rock.

It is expected that the power house at Reflector Bar will be completed during 1932, and the third portion of the scheme is already under consideration. This calls for the erection of a dam, 610 ft. in height and 1,210 ft. in length on the crest, at a point on the Skagit River, six miles above the Diablo Dam. The reservoir thus to be formed will be 30 miles in length and from one to three miles in width. The water will flow from the reservoir to the penstocks along two pressure tunnels 30 ft. in diameter. These will be driven through solid granite for a distance of approximately 600 ft.

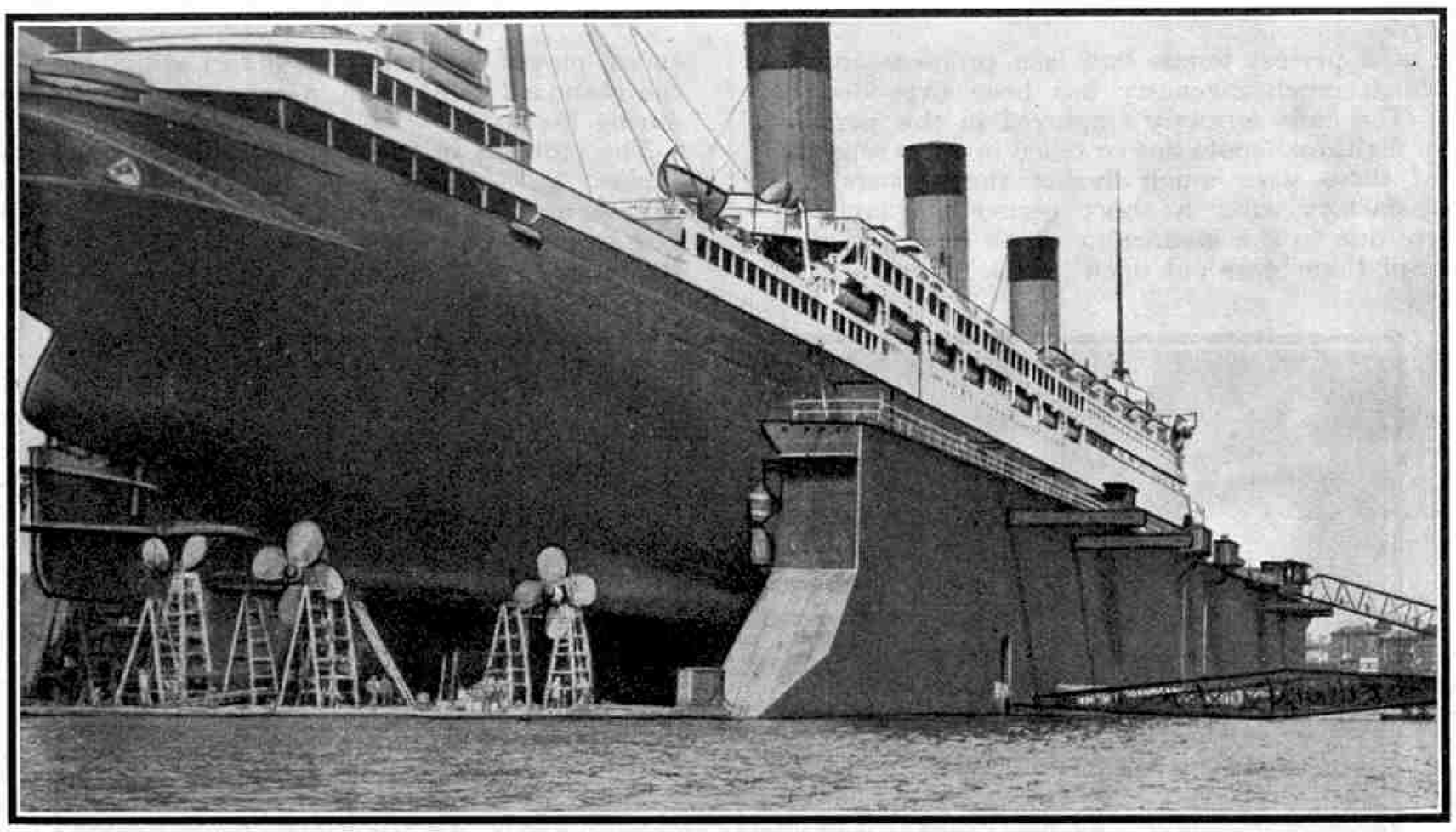
It is expected that the total cost of the scheme will probably be about £18,625,000, and eventually the power developed will amount to no less than 1,120,000 h.p.

Skyscraper Built on Reclaimed Ground

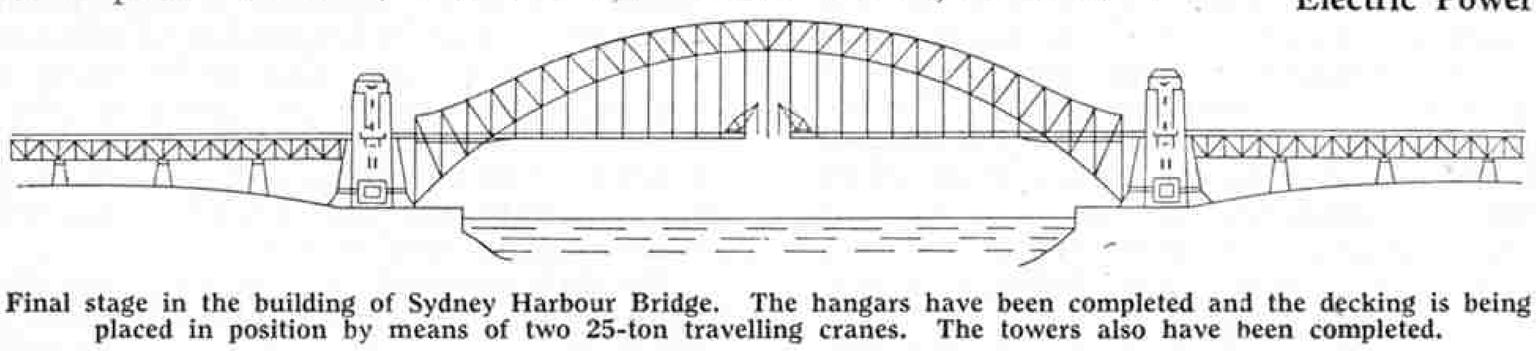
A new ten-storey building at present under construction in New York stands on ground that formerly was covered by the water of the Hudson River, and during the necessary excavation the remains of old docks of wooden construction were actually encountered.

The building is being erected for the *"New York Telegram,"* and before work on it could commence it was necessary to drive no fewer than 373 piles through the silt down to bedrock, which was encountered at a depth of 60 ft. to 70 ft. below ground level. When operations were commenced, water was met at a depth of only 5 ft. and steel sheet piling had to be driven down on three sides of the site before excavation could be completed. The piles required to support the building were then driven, the hammers employed for this work being operated by means of compressed air. Two sizes of pile-drivers were employed. These weighed 6,760 lb. and 10,000 lb., and they were capable of delivering blows of 8,200 ft.-lb. and 15,000 ft.-lb. respectively. Occasionally large boulders or pieces of heavy timber from old piers were encountered. Holes were drilled in these and the piles afterwards hammered through.

The piles themselves are of the concrete-filled tubular type. They are 18 in. in diameter and their walls are $\frac{3}{8}$ in. in thickness. They are arranged in groups of six, each group supporting a pier cap consisting of a large block of reinforced concrete. The work of sinking the piles had to be carried out with great care and precision owing to the necessity for providing evenly distributed support at all parts of the cap. They were therefore arranged symmetrically.



Stern view of the "Majestic" in the world's largest floating dock, at Southampton. This photograph was taken by Mr. G. A. Grant, Leader of the Royal Grammar School (High Wycombe) M.C. during a visit of the members of the club to Southampton.



Final stage in the building of Sydney Harbour Bridge. The hangars have been completed and the decking is being placed in position by means of two 25-ton travelling cranes. The towers also have been completed.

Germany's New Battleship

A new German battleship recently launched at Kiel by President Von Hindenburg possesses many interesting features. The hull of the vessel is not riveted in the usual manner, but is welded, and in her construction extensive use has been made of special light alloys. She is fitted with Diesel engines that have the exceptionally low weight-power ratio of 17½ lbs. to 1 h.p., and these give her a maximum speed of 26 knots.

The *"Deutschland"* has been constructed in accordance with the restrictions imposed on German naval armaments since the close of the War. No warship of more than 10,000 tons displacement may be built in that country and an effort has therefore been made to design a vessel capable of holding her own against much larger warships of the ordinary type. The *"Deutschland"* has the unusually large cruising range of 18,000 miles and her armament is heavy for a vessel of her size, the light welded hull enabling her to accommodate six 11-in. guns in addition to eight 6-in guns, four 3.4-in. anti-aircraft guns and six torpedo tubes. The 11-in. guns fire shells weighing 670 lb. and have a range of 30,000 yds. All six may be swung to concentrate their fire on one side of the vessel. They outrange the guns of most modern battleships and in conjunction with her great speed, will enable the *"Deutschland"* to choose her own conditions for fighting, except against battle cruisers.

Electric Power from Natural Gas

The province of Alberta, Canada, is becoming increasingly important as an oil producer, and special attention is now being given to the further exploitation of the springs of natural gas that occur in the oil fields. It is now proposed to use the gas obtained in the Turner Valley oil fields for the generation of electric power. The site of the power house to be erected is about 30 miles from the springs. The gas will be led to it through piping, and its natural pressure will be used in specially designed turbines. Afterwards the gas will be burned under boilers in order to raise steam. The output of the plant to be installed will be 70,000 h.p. and the cost of the scheme is estimated at £25,000,000. The power generated by the plant eventually will be distributed to consumers residing within a radius of 300 miles of the power station.

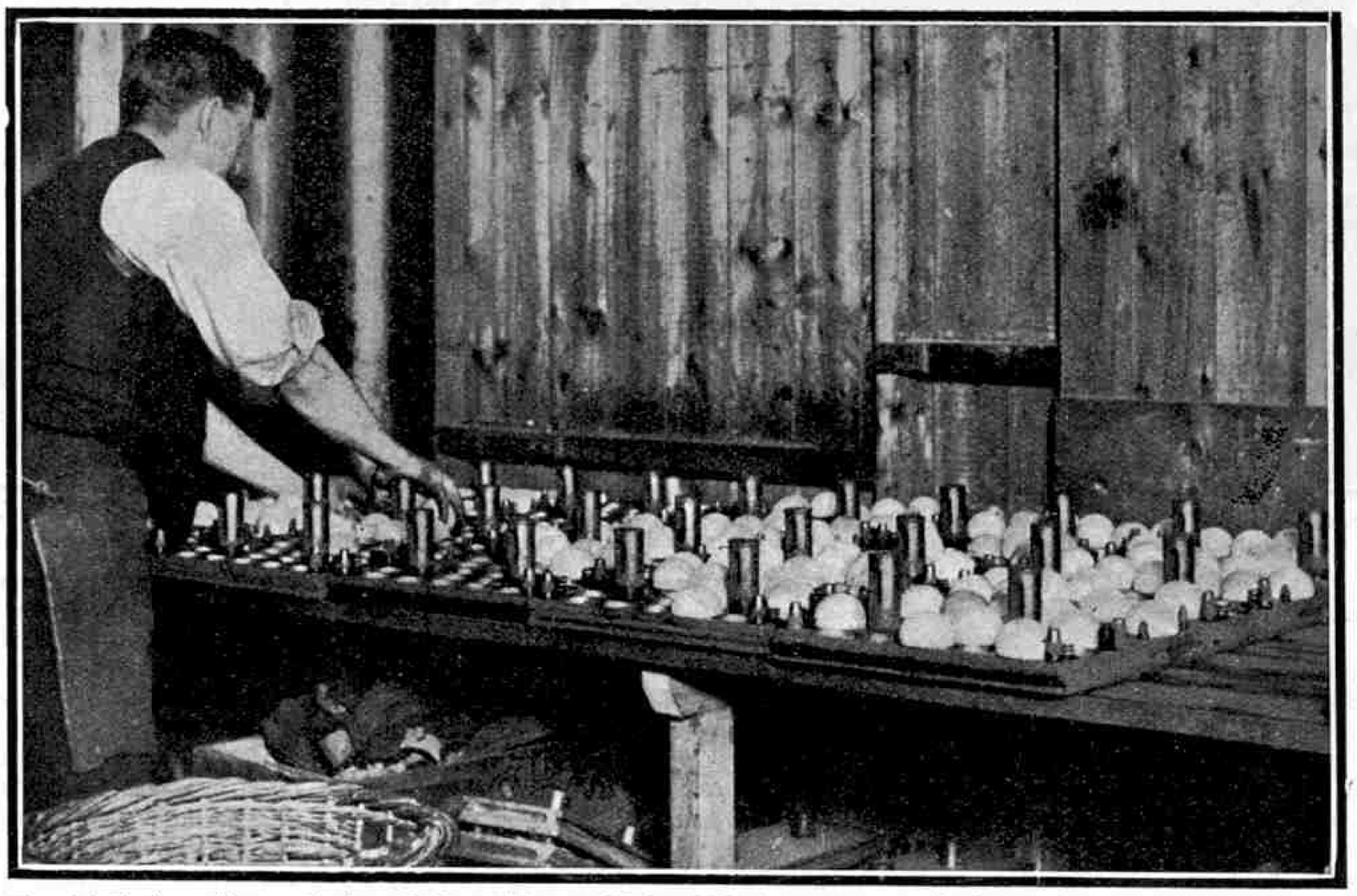
HOW THINGS ARE MADE

Two-piece Stitchless Tennis Balls

The Spalding Factory at Putney

THE production of a perfect tennis ball is a problem on the solution of which much ingenuity has been expended in recent years. The balls formerly employed in this popular game were erratic in flight and could not be relied upon to rebound correctly. Some of them were much livelier than others but none remained satisfactory after a short period of play.

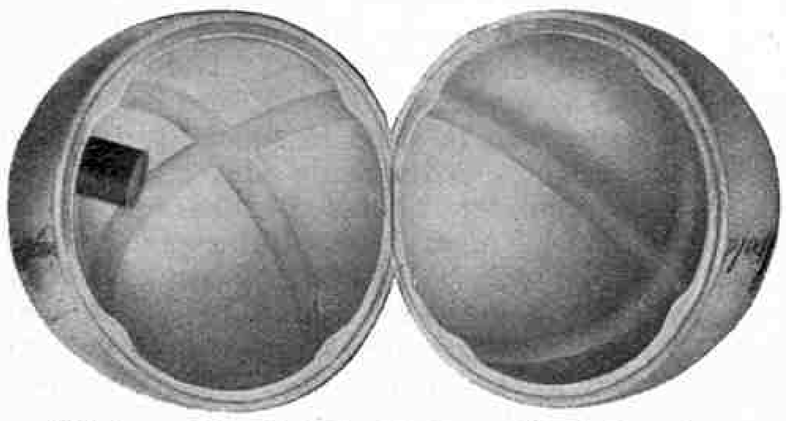
These defects were due to the manner in which the balls were then made. If one of them were cut open it was found to have a heavy plug of rubber on its inner surface. This upset the balance of the ball, of course, for it made one side heavier than the other. Until comparatively recently the plug was universally necessary, however, because it offered the only practical means of getting air inside the ball. The plan adopted was to push a hollow needle through the plug. Through this the necessary air was forced in, the natural resiliency of the rubber closing the hole on the withdrawal of the needle.



Tennis balls in position on the lower halves of the moulds in which they are completed. For the illustrations to this article we are indebted to the courtesy of A. G. Spalding & Bros. Ltd.

One drawback of the old-fashioned method of making a tennis ball was that the air entering was only sufficient to give the ball its shape. Even that air was not completely retained, for slow leakage often took place through the minute opening unavoidably left in the plug by the needle, as well as through pores in the rubber walls of the ball itself. A further difficulty was that the pressure in the interior of the balls sometimes varied considerably, for the amount of air that had to be forced in in order to give the ball its shape depended on the resiliency of the rubber from which it was made. The balls in which the internal pressure was greatest were livelier than others, and when new were more satisfactory. In play they sometimes lost their liveliness, however, and became less accurate in flight.

To-day all this is changed. The balls made by modern processes are exactly alike in size and weight and contain air at a standard pressure. They have no inflation plug to spoil their balance and when dropped upon a concrete base from a height of 100 in. they bound to a height of from 53 in. to 58 in. The result is that on the tennis court they behave alike, and the most experienced player is unable to detect differences in the "feel" of the standard balls with which he plays, or in their behaviour during flight.

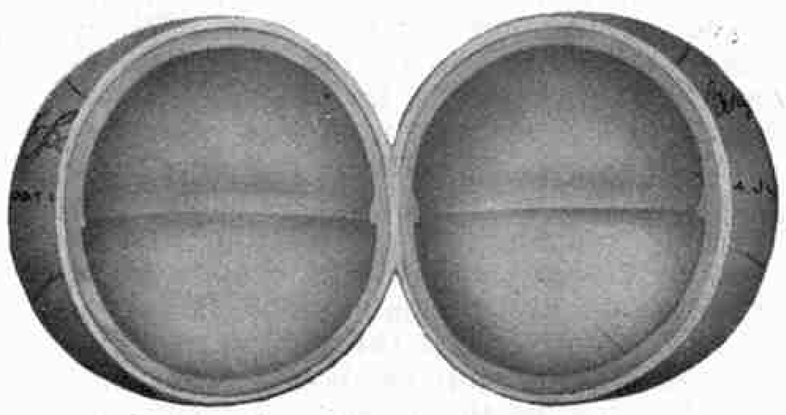


Old type of tennis ball with internal inflation plug.

The pioneers in the production of the modern tennis ball were Messrs. A. G. Spalding & Bros. Ltd., who in 1920 put on the British market the first two-piece stitchless ball. This was the first of the type to be approved by the Lawn Tennis Association. It is now the "Spalding L.T.A. Official Ball," and so thoroughly has the stitchless ball established itself that since 1928 only balls of this kind are allowed to be used at tournaments held under the auspices of the Association.

Apart from the care taken in the choice of materials, the secret of the excellence of the Spalding stitchless ball lies in the ingenious manner in which it is manufactured. The raw material is pure rubber, which reaches the factory of the firm at Putney, London, in the form of thin red sheets. On arrival it is ground between the two revolving cylinders of a mill, from which it emerges in plastic formless lumps that are hot and must be left to cool. They are then fed back into the machine, but this time various chemicals go in with them. The most important of these is sulphur, which combines with rubber under the influence of heat and gives a product that is tough and elastic. Zinc oxide, heavy calcined magnesia and similar materials also are added in proportions that give the finished rubber the qualities required. These are thoroughly mixed up with the rubber, and when the milling process is complete the composite material emerges in the form of large grey slabs about half an inch in thickness.

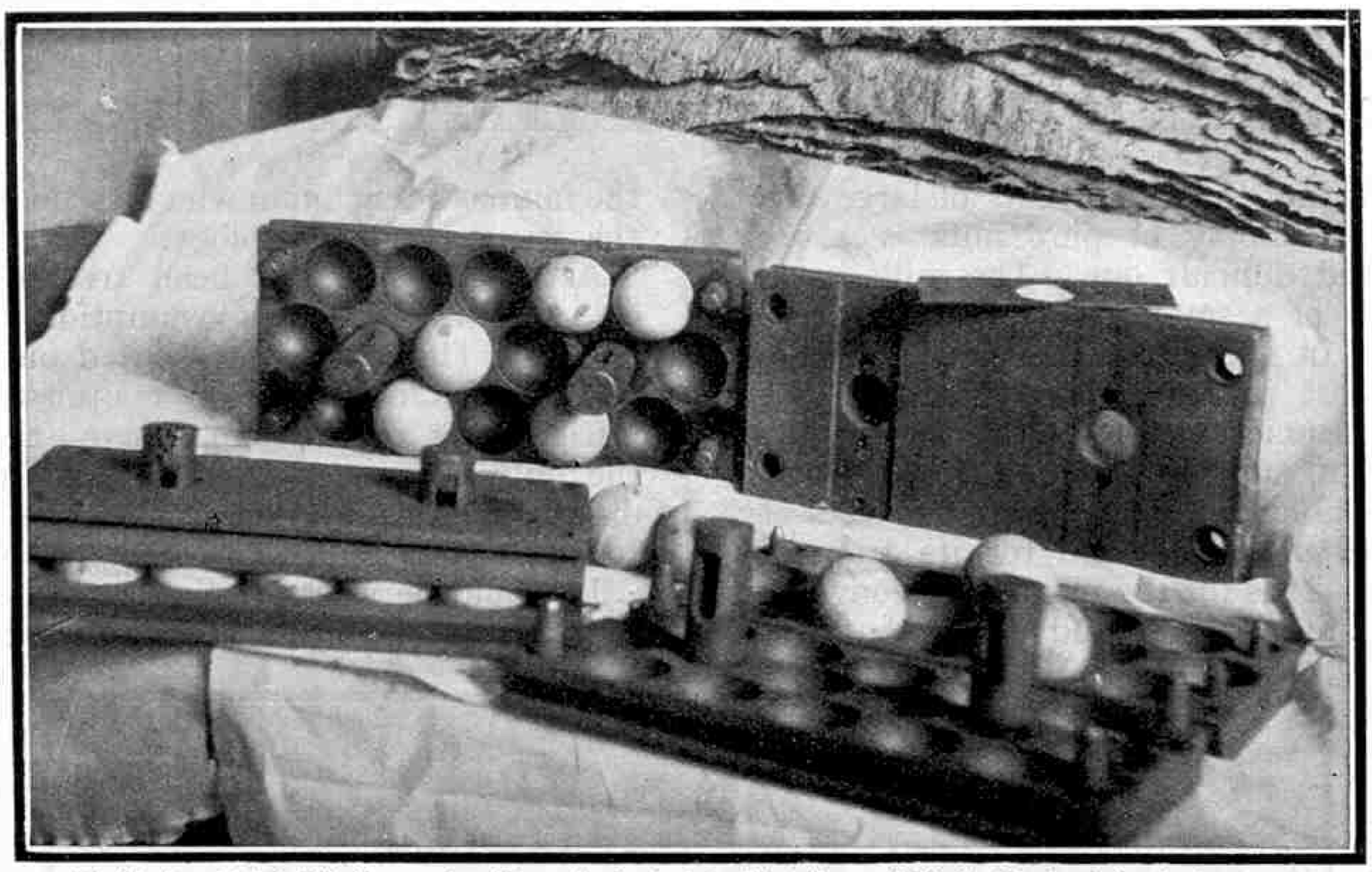
The slabs are next cut into strips and from these circular pieces about $1\frac{3}{4}$ in. in diameter are cut. These pieces are called slugs, and from each slug half a ball is to be made. The next machine through which the material passes is therefore a moulding machine in which the slugs are pressed into shape. Gently but firmly they are squeezed into the moulds and when taken out they are perfect hollow hemispheres, except for a little unnecessary rubber adhering to their edges. To the operators this unwanted rubber is



Tennis ball of the modern stitchless two-piece type.

known as the "flash," and it is quickly removed by means of a machine in which the half-balls are rotated while being pressed down upon a cutting tool.

Before the halves are joined together to form perfect tennis balls, their inner surfaces are given a coating of air-resisting material. The hemispheres are turned inside out and mounted on little cradles that are suspended from travelling chains. The movement carries the hemispheres toward a bath containing a patented quick-drying gelatine solution, into which they dip. Excess of liquid quickly drips off and the hemispheres are practically dry by the time they are lifted from their cradles. They are turned inside out again, in order that the surface that has been coated shall be on the inside of the finished ball, and loose particles of rubber or other materials are cleaned off by means of a revolving brush.

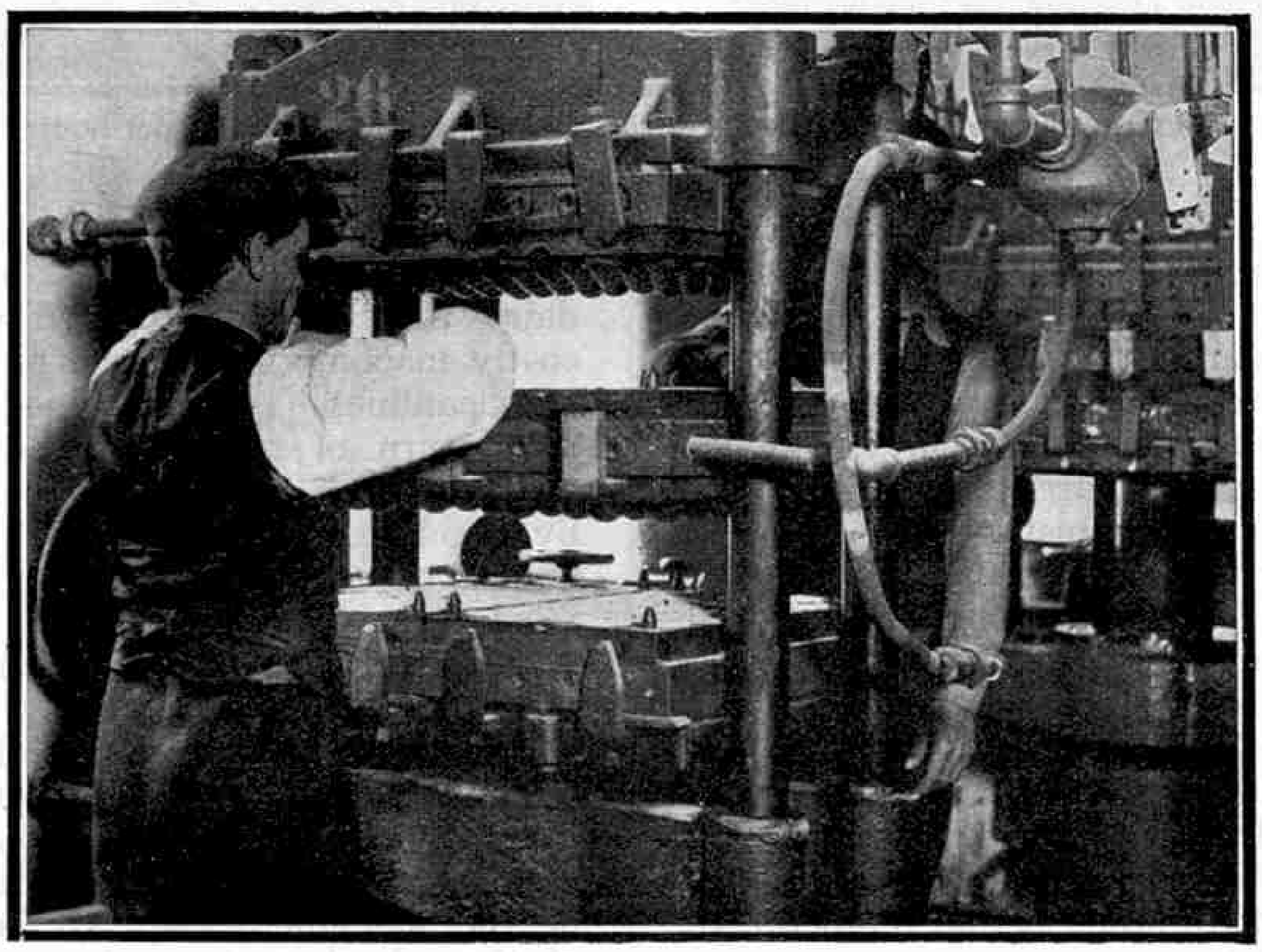


Moulds in which half-balls are placed in order to be joined together and filled with air at standard pressure.

The hemispheres are then ready for transformation into spheres. The making of a tennis ball from the two halves involves a complicated series of operations that are carried out in a continuous machine developed to its present perfection by A. G. Spalding and Bros. Ltd.

Moulds that hold 12 balls are employed in this process. The hemispheres placed in the two halves of each mould are exactly opposite each other in pairs, but to begin with are kept apart by springs. A number of moulds are placed together in a chamber that becomes airtight as soon as the door is closed. This chamber holds 40 moulds at a time and thus 480 tennis balls are fashioned in one operation. Air is pumped in until the pressure is that required for the interior of the balls. A gauge shows when this condition is reached. The process is really automatic, however, for the pressure attained can only be altered by means of a key that is carefully locked in a safe—accessible only to the experts who are responsible for the process.

The air inside the chamber reaches the required pressure in about two seconds, and the operator then releases a hydraulic ram that projects into the chamber and operates a press. The press overcomes the resistance of the springs that has so far kept the two sections of the moulds apart, and thus the halves of the 480 balls within the moulds are brought into contact with each other, the joints being made airtight by means of a cementing solution that has previously been applied to their edges. The compressed air is then allowed to escape from the chamber, leaving the balls inflated to the required pressure. Although the balls are airtight, they are not permanently so, and the rubber at the junction of the two halves must be vulcanised. This process simply consists of raising the temperature of the balls to 300°F. for a certain period.



Moulding machine in which slugs of rubber are pressed into hemispheres, two of which are afterwards joined to form a single ball.

After the vulcanising of the balls has been completed, the door of the chamber is opened and the moulds removed. On cooling, the balls are released from the moulds. They are now perfect in form, except for "flash," or unwanted rubber, that has been squeezed outward when the two halves have been pressed together. This is easily removed by applying the seam of the ball to a revolving wheel, the result being a perfect sphere nearly white in colour, and having a smooth, almost shiny, surface.

After passing through these stages of their production the balls are then given a well-earned rest in what are called "ageing" bins. There they remain for about a week in order that defects may be revealed. Air leaks from a ball that has been improperly cured, or in which the inner surface has not been thoroughly covered with the protective lining, and one that at the end of the ageing period shows signs of loss of pressure is immediately rejected.

The final stage in the manufacture of the balls is begun by churning the smooth rubber spheres in a revolving drum that is lined with a material resembling coarse sandpaper. This roughens their surfaces sufficiently to enable them to "take" the solution used in attaching the covers. From the drum they pass to gauges that ensure their being of a correct size. They are then carefully "dusted" by means of a brushing machine in order to remove any tiny fragments of rubber that may adhere to them, for it is essential that they shall be clean when dipped into the adhesive solution. The dipping is effected by placing the balls in wire cradles suspended from long rods and lowering these into a bath containing the liquid.

The solution does not really become adhesive until it is "tacky," or nearly dry, in this respect resembling the solutions that are used in applying patches to the inner tubes of pneumatic tyres. After dipping, therefore, the balls are left for a while. In the meantime the pieces of cloth that are to be used in making the covers have been prepared. Two are required for each ball. They are cut to a shape resembling that of a figure 8 with a fat waist, the exact shape having been carefully worked out to ensure that the entire surface of the ball shall be covered.

The covering begins with a test, for with the two pieces of cloth that are about to be applied to it, each ball is weighed. If the total weight is correct the ball is placed between four upright pillars that form the corners of a square large enough to accommodate it. The pillars serve as guides to the operator, who applies the two pieces of the cover, and also prevent the ball itself from moving about during the process. At this stage the two pieces are only caused to adhere to the ball sufficiently to prevent them from being easily pulled away. In this condition the balls are passed on to other workers, who complete the process by pressing the covers firmly down by means of patent Spalding revolving arches on a long shaft. After this the balls are marked, wrapped in damp-proof envelopes and placed in cardboard boxes ready for despatch to the shops all over the world at which they are sold.

Washing 10,000 Bottles per Hour

Automatic Machines that Ensure Clean Milk Supplies

By H. G. Gaskell

THE task of providing the inhabitants of large cities with a plentiful supply of pure milk is a very complicated and difficult one. The milk supply of a village, or even of a small town, may readily be obtained from firms in the immediate neighbourhood, and little time is lost in transferring it direct from the dairy to the consumer. But in the case of large cities, such as London, supplies must be drawn from a very large area and elaborate arrangements are necessary for the collection of milk and also for its transport over great distances. It is for the purpose of conveying large quantities of milk quickly and easily that huge glass-lined tanks capable of holding hundreds of gallons of milk have been introduced on our railways. Readers of the "*M.M.*" no doubt will be familiar with these from the miniature reproductions now forming part of the rolling stock of the Hornby system.

In dealing with milk intended for human consumption the greatest care must be taken to use clean vessels and to exclude all danger of contamination by dirt, for otherwise the milk may become sour. This change is brought about by the action of microscopic organisms called germs or bacteria, and the danger is particularly acute in warm weather.

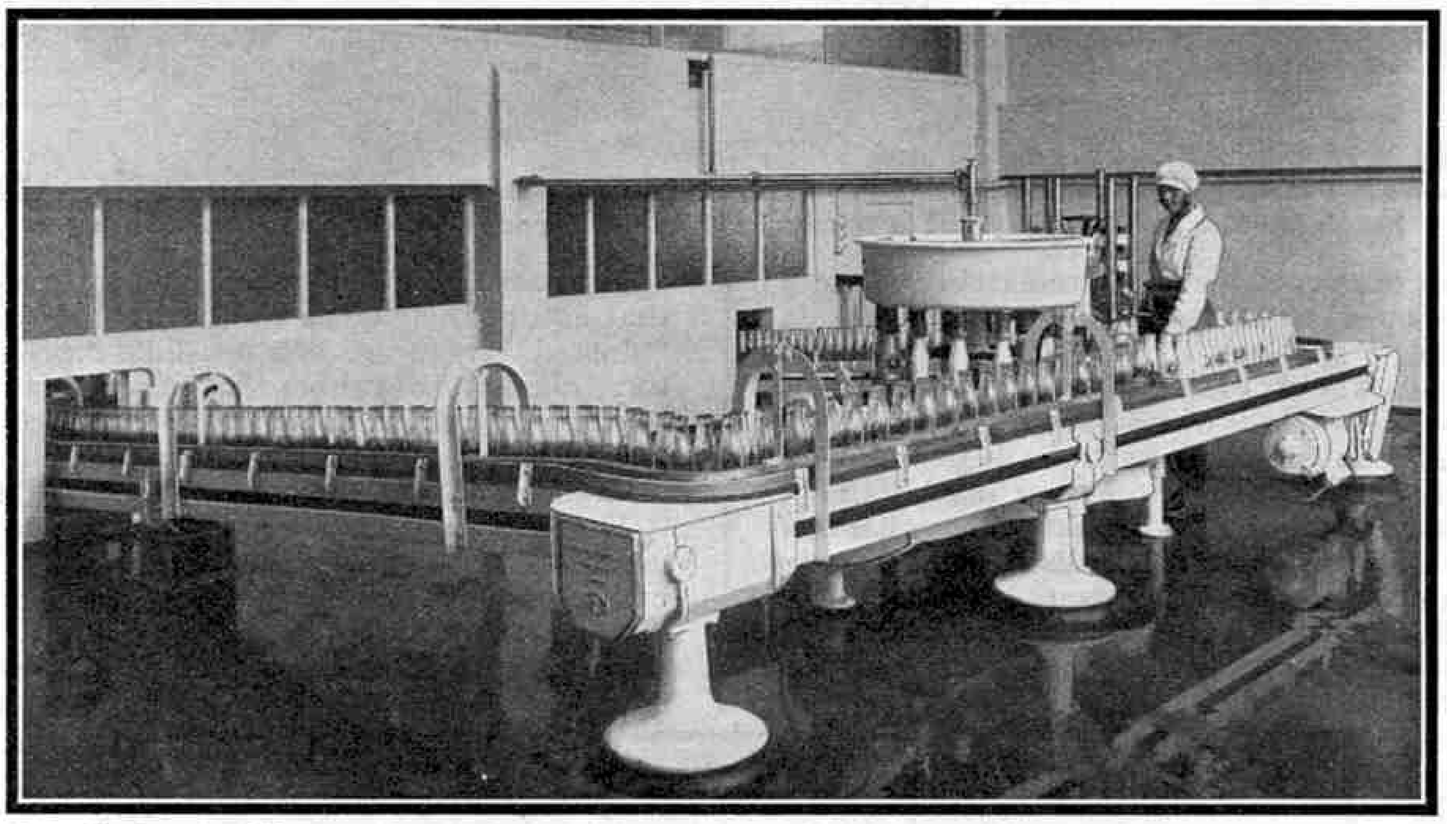
Even perfect cleanliness is not always successful in preventing milk from becoming sour, however, particularly when it has to be carried over long distances, and under certain circumstances the liquid may even become a carrier of disease. In order to safeguard the health of consumers therefore special treatment is necessary, and this is carried out quickly and efficiently in modern dairies.

The first step in this treatment is to pre-heat the milk to 90°F., for it has been found that at this temperature it can be most readily cleansed either by centrifuging or filtering. After cleaning, the milk is then further heated to 145°F. and it is maintained at that temperature for a period of 30 minutes.

The milk is heated in jacketed vessels, through the outer compartments of which steam is passed, or through which water previously heated to the required temperature is allowed to flow. This simple means of destroying germs is called "pasteurisation" and is the direct result of the wonderful pioneer work of Louis Pasteur, the famous Frenchman who may be said to have founded the science of bacteriology.

After the milk has been treated in order to make it safer for human consumption, it is necessary to cool it. This process is carried out by means of milk coolers which are run in conjunction with the dairy refrigerating plant. In these the temperature of the milk is lowered to 40°F. and it is then ready for distribution. For this purpose it is passed forward to the bottle filling and capping plant.

It would be waste of time and money to ensure that treated milk only is forwarded to the distributing centres of large cities unless means also were taken to prevent access by germs in later stages. In many respects this is more difficult than pasteurisation itself, for before reaching its destination the liquid often is carried over long distances. Risk of contamination is best avoided by using bottles with tight-fitting caps and containers of this kind are rapidly becoming popular.



A milk bottle filling and capping plant capable of handling 5,000 bottles per hour. The bottles are filled automatically from the circular tank.

The bottles in which milk is distributed must be thoroughly cleansed before use and sealing must be efficient, and a modern dairy therefore is equipped with very elaborate and costly machinery for these purposes. A high standard of cleanliness is maintained throughout, and from the return of the empty bottles to the despatch of fresh supplies of milk the containers are not touched by hand except when being packed in crates for distribution. By that time, of course, they have been filled and sealed.

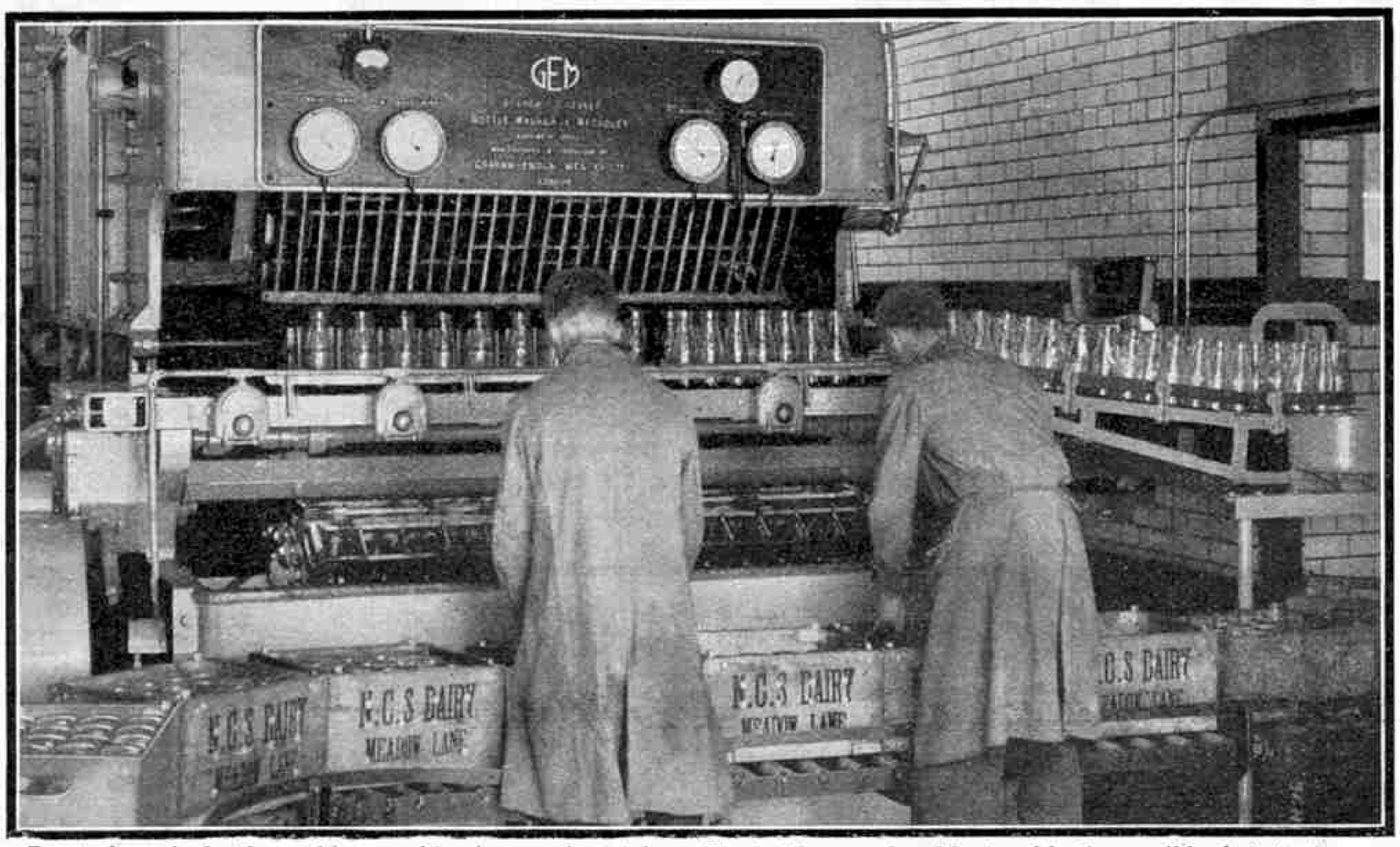
On reaching the dairy the crates containing the dirty returned bottles are placed on a sloping roller conveyor, on which they slide along the front of the washing machine. There two operators transfer the bottles from the crates to baskets, fixed in rows on endless moving chains, that carry them into the depths of the machine itself. In large plants there are 14 of these baskets in each row and the rows are continuous along the whole length of the chains. In them the bottles are held in position by an automatic locking bar in order that they shall not fall out when the baskets are inverted.

The bottles pass slowly through a tank of tepid water and are then plunged successively into two baths of hot

cleansing solution, the second of which is at a higher temperature than the first. This brings the baskets to the back of the machine and in order to commence the return journey they are carried upward. During their ascent the bottles are almost horizontal, and powerful jets spray the hot solution from the last tank on their inner and outer surfaces. The liquid flows over the bottles and falls into the tank, from which it is pumped back again through the jets.

When the baskets reach the top of the machine they begin to travel towards the front. They are now in an inverted position and again they are sprayed by means of a series of jets. The first set of these wash their surfaces with more detergent solution. The remainder drench the bottles with water, these jets being divided into three sections that discharge hot, tepid, and cold water respectively. This ends the treatment. The bottles are now perfectly clean and ready to leave the machine.

It will be remembered that the bottles are locked in the baskets and their release and delivery is carried out automatically. The locking bar is removed at a point where the baskets are moving downwards and the bottles are inclined at an angle of about 45 degrees. This movement leaves the latter free to slide out of their baskets. They do not fall out immediately, for a little below the baskets is a guard against which they strike. The baskets continue to move downward and the bottoms of the bottles slide along the guard until the end of this is reached. Then they slip through into recesses on a sloping ledge. The latter is slowly pushed into an upright position and a bar comes forward to thrust a row of 14 bottles on to a moving conveyor that carries them out of the machine.



Front view of a bottle-washing machine in a modern dairy. The bottles are placed by hand in the small baskets that carry them into the machine, but all other operations are entirely automatic, the clean bottles being removed on a conveyor.

From the washing machine the bottles are immediately carried mechanically to a filling and capping machine. The most modern type of this machine works on the rotary principle, and the largest made deals with 5,000 pint bottles per hour. The washing machine already described cleans 10,000 bottles in the same length of time and is thus capable of supplying two filling machines with the necessary containers.

From the moment when the bottles are put into the baskets of the washing machine every movement is automatic. A moving arm transfers the clean bottles one by one from the conveyors to pedestals arranged at intervals along the circumference of a round table that revolves under the milk container. As the bottles are carried round they are pushed up and the movement brings their necks into contact with valves in the base of the milk bowl. The pressure is sufficient to open the valves and milk flows through into the bottles.

On reaching a certain point in its circuit each pedestal drops back to its original level, the valve is closed and the supply of milk cut off. All that remains now is to fix the cap in position. This is done on a machine similar to that used for filling, the upward pressure due to the raising of the pedestals forcing on the cap.

As the bottles complete their circuit of the capping machine they are swiftly transferred to another moving conveyor. This carries them forward to a point where they meet the empty crates from which the dirty bottles were removed before entering the washing machine. While the bottles have been passing through the three machines the crates have continued their career on the roller conveyor and are now ready to be filled again. Into them the full bottles of milk are placed by hand and they are ready for transference to the motor vans and other vehicles by means of which they are distributed to the consumers.

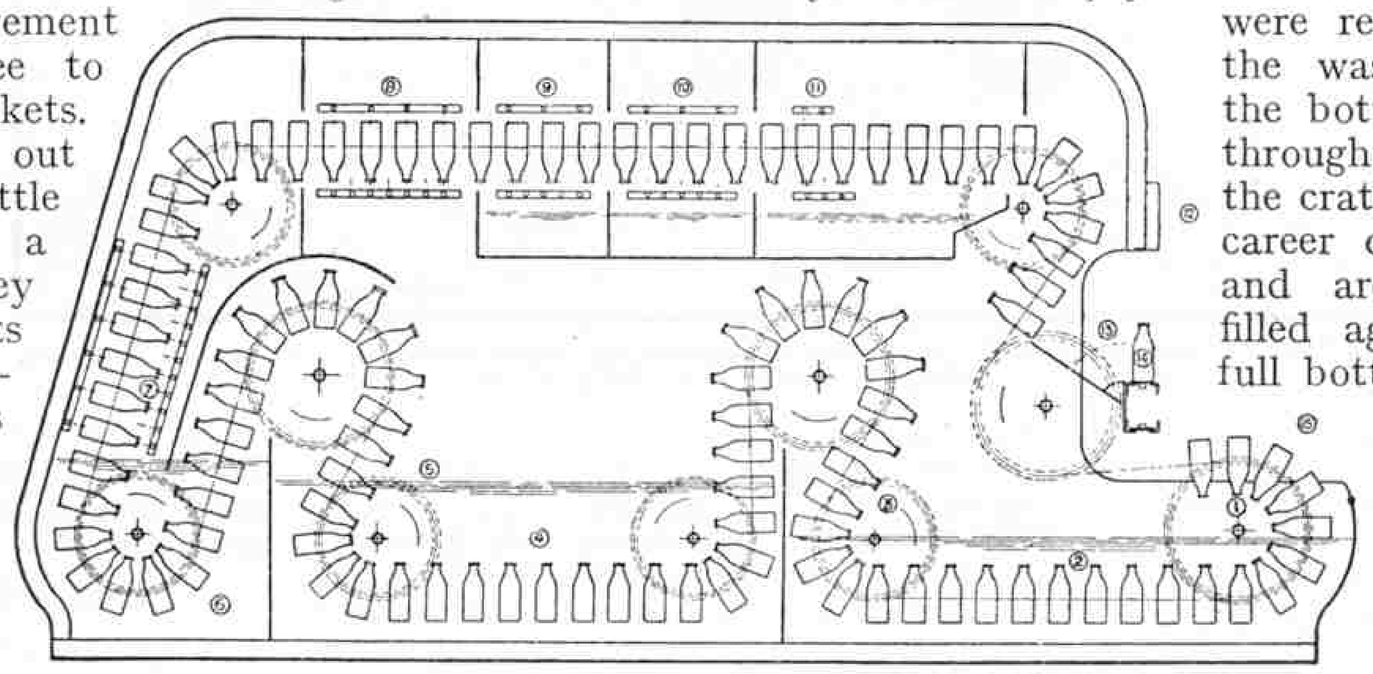
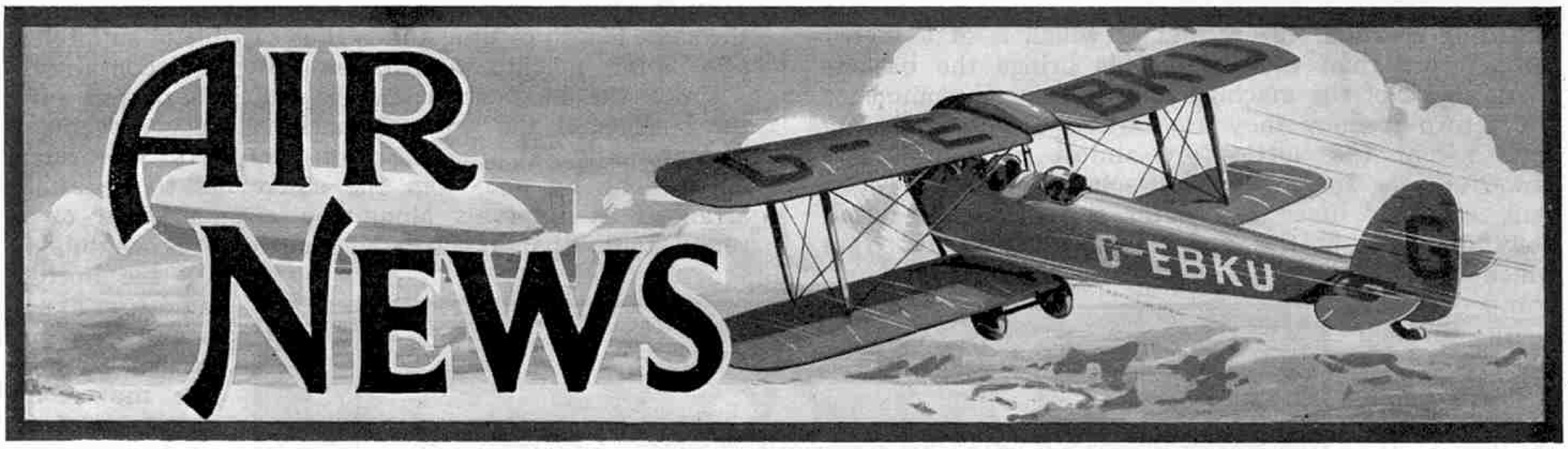


Diagram showing the course of milk bottles through a washing machine. In tanks 2, 4, and 6, they are soaked in hot cleansing solutions with which they are sprayed inside and outside. Rinsings with hot and cold water in the remaining compartments Nos. 7 to 11 complete the washing.

The treatment of milk and the use of machinery in dairies have completely transformed the conditions under which this valuable foodstuff is produced and distributed. It is seldom in real danger of contamination, particularly if milking machinery is employed, and when sealed in bottles it is completely protected from access by dirt and disease germs. In addition, improved means of transport have greatly speeded up its distribution, and to-day it arrives at its destination in a state as pure as when it leaves the dairy.



The 1931 King's Cup Race

The 1931 race for the King's Cup is to take place on the 25th of this month. The race will start from Heston, London, which is also the finishing point. A call will be made at this aerodrome during the event and the total distance to be covered is 980 miles.

From Heston the machines will proceed via Leicester to Norwich, where they will land to refill their tanks. They will then fly to Northampton, Brough and Sherburn-in-Elmet, near Leeds, where the second stop will be made. This is the most northerly point that will be reached during the race, for the machines will then fly directly south to Birmingham, and afterwards in a north-westerly direction to Woodford, Manchester and Hooton, Cheshire. From Hooton, a straight flight of 165 miles will be made to Heston, and the final stage of the race will be flown over a circular course that proceeds by way of Shoreham, near Brighton, Hamble, near Southampton, and Bristol.

New Indian Air Route

An air route connecting Karachi, Delhi and Calcutta is to be inaugurated on 1st January, 1932, by the Indian State Air Service. At present a service from Karachi to Delhi is operated by Imperial Airways Ltd. under agreement with the Indian Government. The agreement expires on 29th September of this year, and the Indian State Air Service will then operate machines over the route, and later will extend the service to Calcutta. Avro "Ten" monoplanes equipped with Armstrong Siddeley "Lynx" engines are to be employed.

Andes Crossed in Training Machine

Captain Norman MacMillan recently made an interesting flight in South America in an Avro "Trainer," crossing the Andes twice during a flight of more than 1,800 miles that commenced and finished at Mendoza, Argentina. The second crossing of the Andes was made near Aconcagua, the highest peak in the range, the summit of which is 23,910 ft. above sea level.

Diesel Engine Used in Record Flight

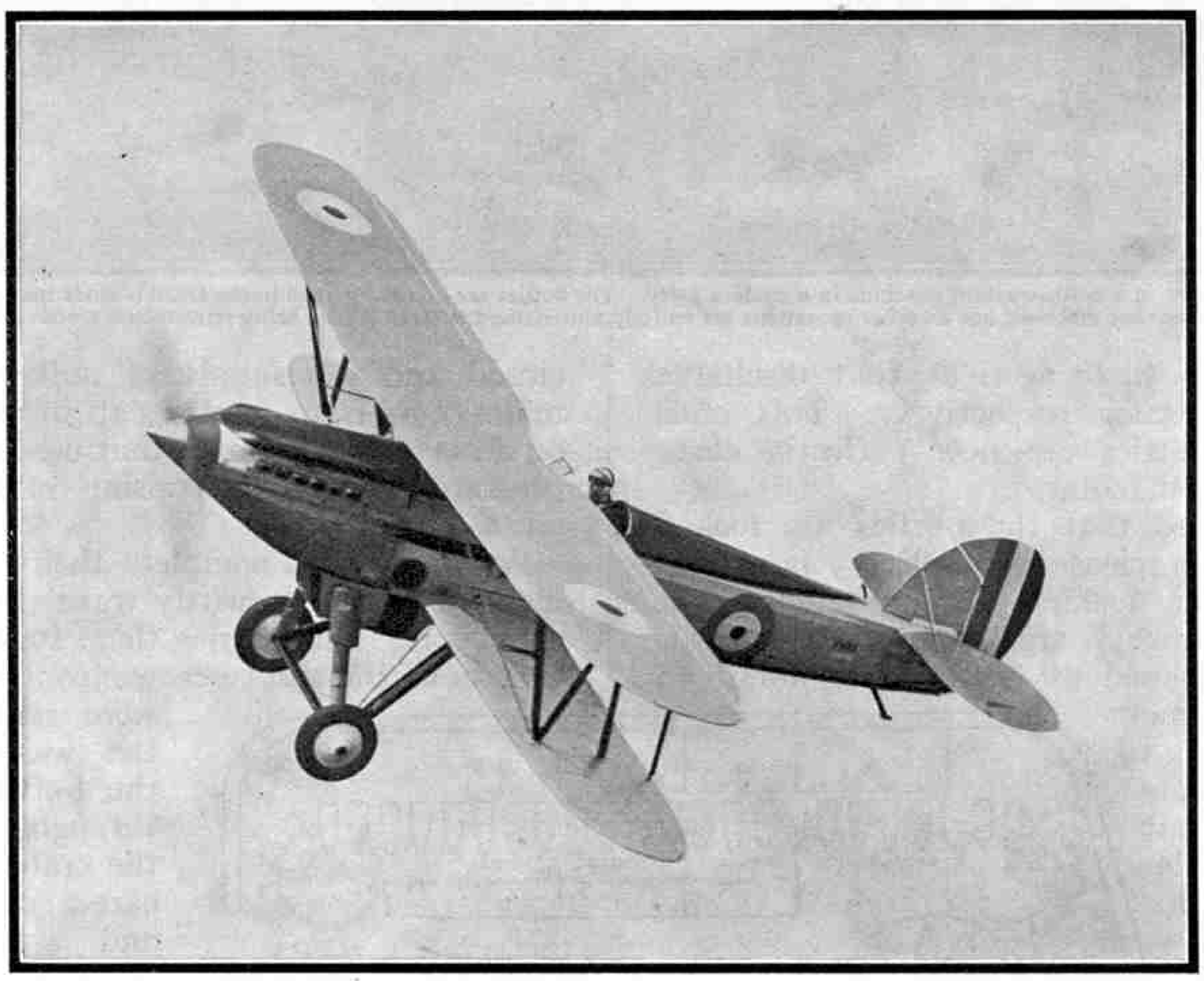
A flight that has set up a new duration record for America has been made by two American pilots in a Bellanca monoplane equipped with a 225 h.p. Packard Diesel engine. The machine stayed in the air for 73 hrs. 48 min. and thus exceeded the previous record by 14 hrs. 29 min.

A violent storm made landing necessary, otherwise it is probable that the world's duration record also would have been broken. This was set up recently by M.M. Bossoutrot and Rossi, two French airmen, who remained in the air for 75 hrs. 22 min. This was only 1 hr. 35 min. longer than the time of flight of the American machine, in the tank of which fuel for ten hours' flying remained at the conclusion of the flight.

When the machine took off the gross load was 6,666 lb. and 458 gallons of fuel oil were on board.

A second attempt to secure the world's duration record was afterwards made. This was completely successful, the aeroplane remaining in the air for 84 hours 33 min. In both efforts the pilots of the "Bellanca" monoplane were Walter Lees and Frederick A. Brossi, of Detroit.

It is stated that only 398 gallons of fuel were carried on the second attempt.



The Fairey "Firefly 11M" high performance single-seater interceptor fighter at speed. This illustration is published by courtesy of the Editor of "Flight."

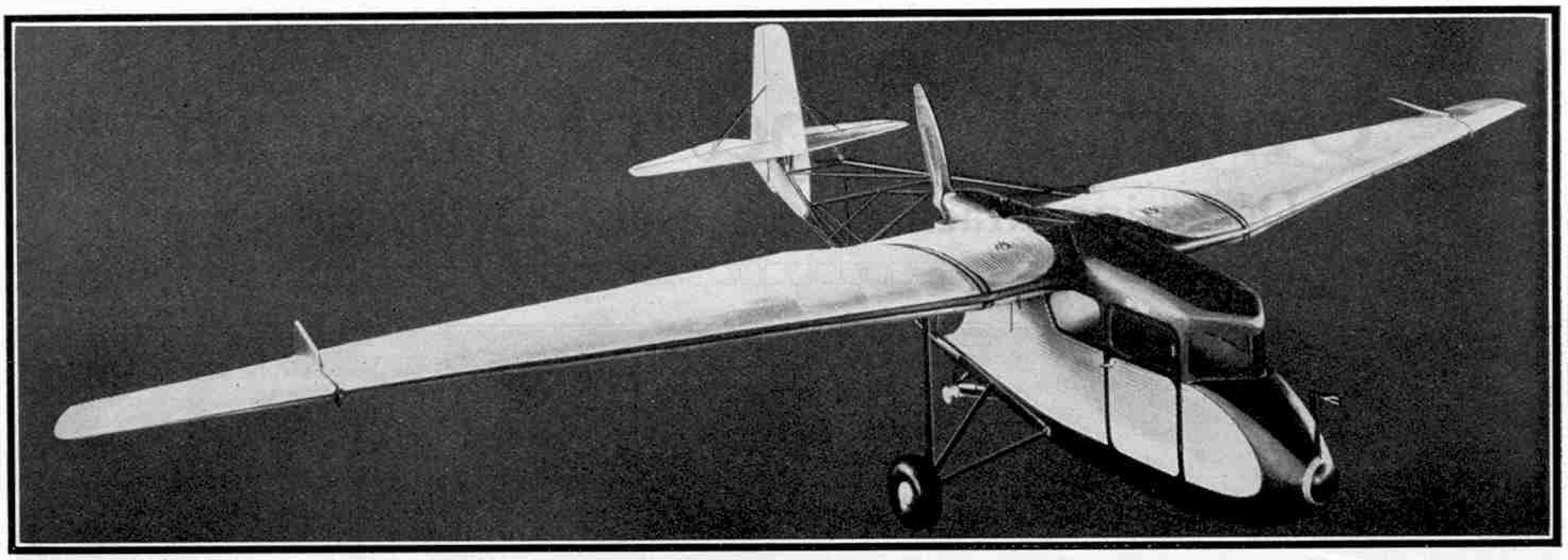
"*Graf Zeppelin*" to Fly to the North Pole

Dr. Eckener has been asked by an American newspaper proprietor to undertake a flight in the "*Graf Zeppelin*" to the North Pole. The interesting Arctic voyage of the airship will be so timed that a meeting may take place between Dr. Eckener and Sir Hubert Wilkins, the Australian explorer, who has already started on a voyage across the Arctic Regions in a submarine. The airship is much speedier than the submarine, of course, and therefore will not start on the journey until news has been received by wireless that the "*Nautilus*," Sir Hubert Wilkins' vessel, is within two days' journey of the Pole.

The submarine is provided with means for boring through the frozen surface of the Polar seas, and no difficulty in establishing contact between the two parties is expected. The "*Graf Zeppelin*" will carry sledges, boats, clothing and provisions to enable the crew and passengers to return southward in the event of accident. There will be at least 45 persons on board, included among whom will be a number of scientists and experienced Arctic travellers. If Dr. Eckener is successful the "*Graf Zeppelin*" will be the second airship to visit the Pole, her predecessor being the Italian vessel, the "*Norge*," in which Amundsen flew to Alaska in 1926.

London-Berlin Night Service

A night passenger service connecting London, Cologne, Hanover and Berlin is now in regular operation. Guiding lights have been installed along the whole of the route. The night flying arrangements are particularly good between Hanover and Cologne, for along this part of the route revolving beacons have been erected every 15 miles and landing grounds prepared at intervals of 30 miles. During foggy weather aeroplanes operating on the route will be directed entirely by means of wireless. The aerodrome at Cologne has been specially fitted with modern lighting and signalling equipment at a cost of more than £5,000.



The Stout "Sky Car," a novel American monoplane illustrated and described in the article on "Unusual Types of Aircraft" that appears on page 558 of this issue. Our photograph is reproduced by courtesy of the Editor of "The Aeroplane."

Giant Mobile Mooring Mast for Airships

A giant movable mooring mast weighing 130 tons is being completed at the airship factory of the Goodyear Zeppelin Company at Akron, U.S.A. The mast has been designed to pull the world's largest airship in and out of its hangar. It is 76 ft. in height, and is electrically driven, the generator being operated by means of a petrol engine developing not less than 240 h.p.

The mast is of the low or "stub" type developed by the U.S. Navy at Lakehurst, N.J., and used with success during the past two years' manœuvres of the U.S. Naval airship "*Los Angeles.*" It is a tripod with the corners of its triangular base equally spaced on a circle 100 ft. in diameter. At each of the three corners is a caterpillar tractor. The two rear tractors serve to drive the mast forward, the one in front being used for steering purposes.

A small power house on the base of the mast contains the 240 h.p. petrol engine and the generator. The current produced is supplied to a 125 h.p. motor underslung on the framework between the two rear tractors, and this moves the mast at a speed of 2 m.p.h. Electrical drive is employed in order that the tractors, and with them the mast and the bulky airship, may be driven smoothly and steadily. Reverse gear is fitted.

The new mast is capable of providing an all-night mooring for an airship but will only be used for this purpose in case of emergency.

Flying Boats for American Submarines

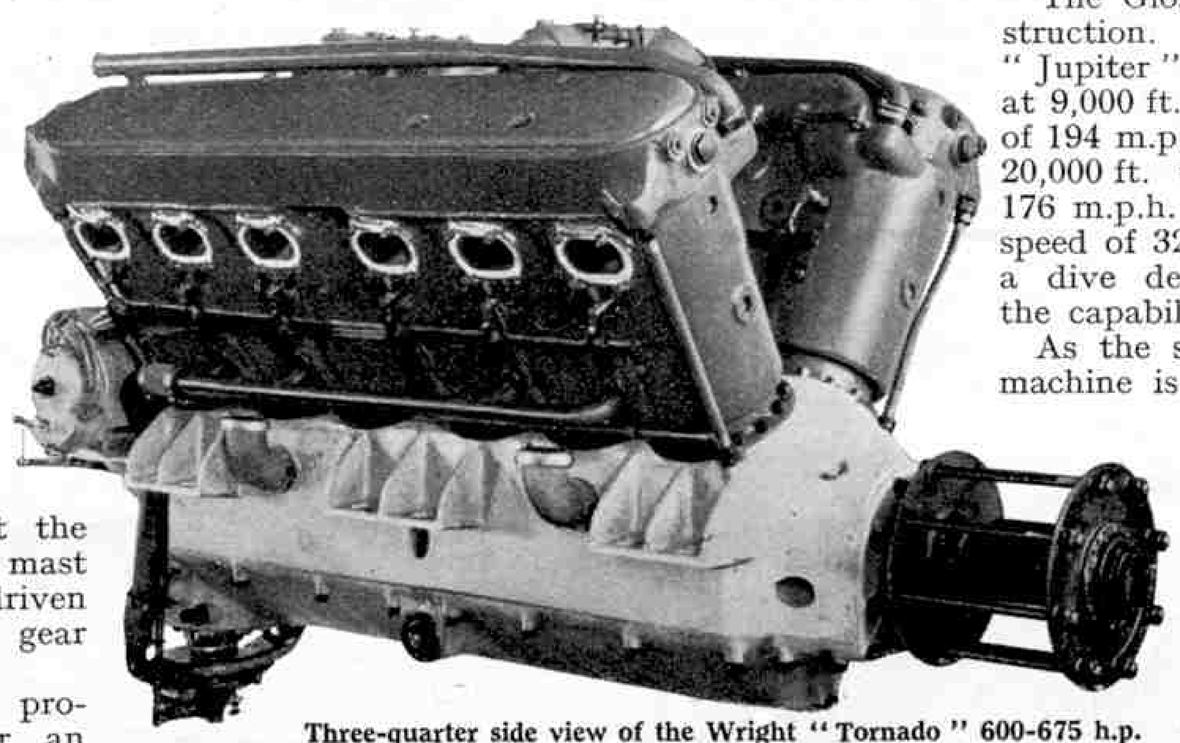
The U.S. Navy Department recently have adopted a new type of flying boat designed to be carried in submarines. The boat is constructed by the Loening Aircraft Corporation and is a single-seater monoplane fitted with a 100 h.p. engine that operates a pusher propeller. The wings have a span of only 36 ft. and can be folded back. An unusual feature is that the engine, which is mounted on struts above and to the rear of the pilot's seat, also may be folded back on to the hull when the machine is not in use.

It is said that the new flying boat is carried in a special tube attached to the submarine.

World's Largest Military Flying Boat

A military flying boat constructed by Short Bros. Ltd., Rochester, for the Japanese Navy is claimed to be the world's biggest and most powerful all-metal military flying boat. Great secrecy was maintained while the construction work was in progress and details of the machine are not available. It is known that the boat is fitted with three 825 h.p. Rolls-Royce "Buzzard" engines and preliminary trials are said to have proved very satisfactory. Future editions of the new flying boat will be constructed by the Kawanisi Aircraft Co. Ltd., of Kobe. This company have been granted a license to construct Short metal flying boats and are also the sole Japanese agents for Rolls-Royce Ltd.

It is interesting to note that Short Brothers have also granted a license to construct Short machines to the well-known Societé d'Aviation Louis Breguet in France. This firm is now constructing a large factory at Havré, where Short flying boats will be built.



Three-quarter side view of the Wright "Tornado" 600-675 h.p. water-cooled aero engine constructed by the Wright Aeronautical Corporation, to whom we are indebted for this photograph.

1,400-Mile Flight in One Day

A flight from London to Copenhagen and back in one day was made a short time ago by Mr. Neville Stack and Mr. J. R. Chaplin in a Vickers-Napier biplane. During their journey of 1,400 miles they flew at an average speed of 124 m.p.h., the actual time of the flight being 11 hours 15 min., in spite of bad weather conditions.

Single-Seater Fighter with Six Guns

An interesting new single-seater fighter known as the S.S.19 has been produced by the Gloster Aircraft Co. Ltd. Its most remarkable feature is that it is fitted with six machine guns. Most single-seater fighting machines carry two machine guns synchronised to fire through the airscrew. In the Gloster S.S.19 two of the six guns fire through the airscrew in the normal manner, the remaining four being mounted on the wings. All six are arranged to concentrate their fire on a point between 100 ft. and 300 ft. in front of the machine, and an enemy machine that has been manœuvred into the line of fire can scarcely avoid being hit in some vital part.

The Gloster S.S.19 is of all-metal construction. It is equipped with a Bristol "Jupiter" engine developing 480 h.p. at 9,000 ft., and giving a maximum speed of 194 m.p.h. at 10,000 ft. At a height of 20,000 ft. the machine has a speed of 176 m.p.h. During trials the tremendous speed of 320 m.p.h. was registered during a dive deliberately undertaken to test the capabilities of the machine.

As the service ceiling is 26,100 ft. the machine is fitted with oxygen apparatus for the pilot. The time occupied in climbing to 5,000 ft. is 2 min. 5 secs., while the altitude of 20,000 ft. is reached in 12 min. 54 secs. In spite of the high speeds that can be attained by the machine, the landing speed is only 57 m.p.h. and the landing run is 170 yds. The aeroplane requires a run of 125 yds. in order to take-off.

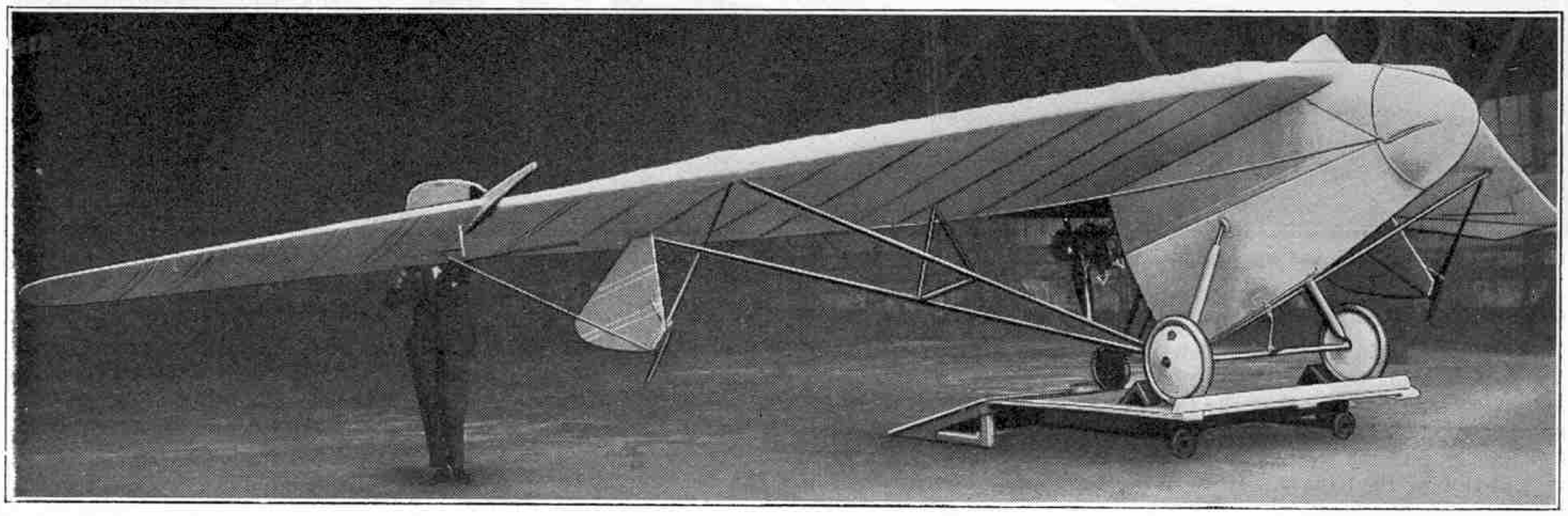
Commercial Flying in Australia

Figures recently made available by Australian International Airways Ltd. of Sydney, N.S.W., show that during 1930 their fleet of five Avro "Tens" completed 1,162 out of 1,164 scheduled flights, the exceptionally high efficiency of 99.8 per cent being maintained.

The total distance flown by the machines was 202,150 miles and over 6,000 paying passengers were carried. The number of air mail letters carried was 717,000, their total weight being 17,000 lb. The average speed maintained on all scheduled flights was 105 m.p.h., and it is interesting to note that there were no accidents in which passengers or personnel were injured.

Unusual Types of Aircraft

Designing Machines to Make Flying Safer



UNUSUAL aircraft may be divided into two classes—those that fly and those that do not! Of the second class there have been a very large number, for probably in no other sphere has the imagination of the inventor gone so far as in that of aviation. The creation of a flying machine that is capable of rising vertically in the air and of hovering motionless over any given spot has for many years been the dream of men in all civilised countries. Few of these dreamers have reached the stage of making working drawings of their inventions. Still fewer have attempted to build a model or to construct a full-size machine in accordance with their ideas. It is perhaps fortunate that this is the case, for there is no doubt that practical trials of many of the remarkable machines that have been suggested could only end in disaster.

Aeroplanes are no longer mere objects of wonder and their design is based on knowledge and experience. To-day the chief requirement is to produce machines that are safe. In trying to achieve this aim, one school of designers has adopted the ordinary aeroplane as a starting point, and every year sees the introduction of aeroplanes that are capable of climbing more quickly and require less room on the ground in which to manœuvre than those of older types, and also do not stall, or lose flying speed, so easily. Efforts are continually being made to break away on entirely new lines, however. So far the chief practical results of these efforts has been the production of the Cierva "Autogiro" and of helicopters of various types. In addition, a large number of weird machines depending on other principles have been suggested. For instance, some inventors appear to be convinced that safe flying can only be achieved by imitating the movements of a bird, and they have tried to build ornithopters, or machines that fly by flapping huge wings. None of these machines have had any success, and for the present, at any rate, they may be disregarded.

The Focke-Wulf "Ente," an interesting machine that flies with the main plane in the rear. For this photograph we are indebted to the Focke-Wulf Flugzeugbau A.G. The upper illustration on this page shows an early model of the Westland-Hill "Pterodactyl" and is reproduced by courtesy of the Westland Aircraft Works.

The "Autogiro" is the most successful of the machines of unusual design that have been developed. For its lift it depends on four rotating vanes that are shaped like the wings of an aeroplane. A helicopter, on the other hand, would literally screw itself into the air instead of deriving lift from the use of a wing driven at high speed. Although promising efforts are being made to develop flying machines of this type, no real practical success has yet been attained. In the present article therefore we propose to deal only with developments that may be said to be based on the knowledge and experience gained with ordinary aeroplanes.

Although the machines described in this article are of unusual design they have been planned in accordance with sound practical ideas, and on development, they may be instrumental in hastening the coming of the foolproof aeroplane. The chief thing to be looked for in such a machine is absence of danger from stalling, or loss of flying speed. When the forward speed of an ordinary aeroplane falls below a certain limit it is no longer able to maintain itself in the air, and the majority of fatal aeroplane accidents are due to the stall that immediately results.

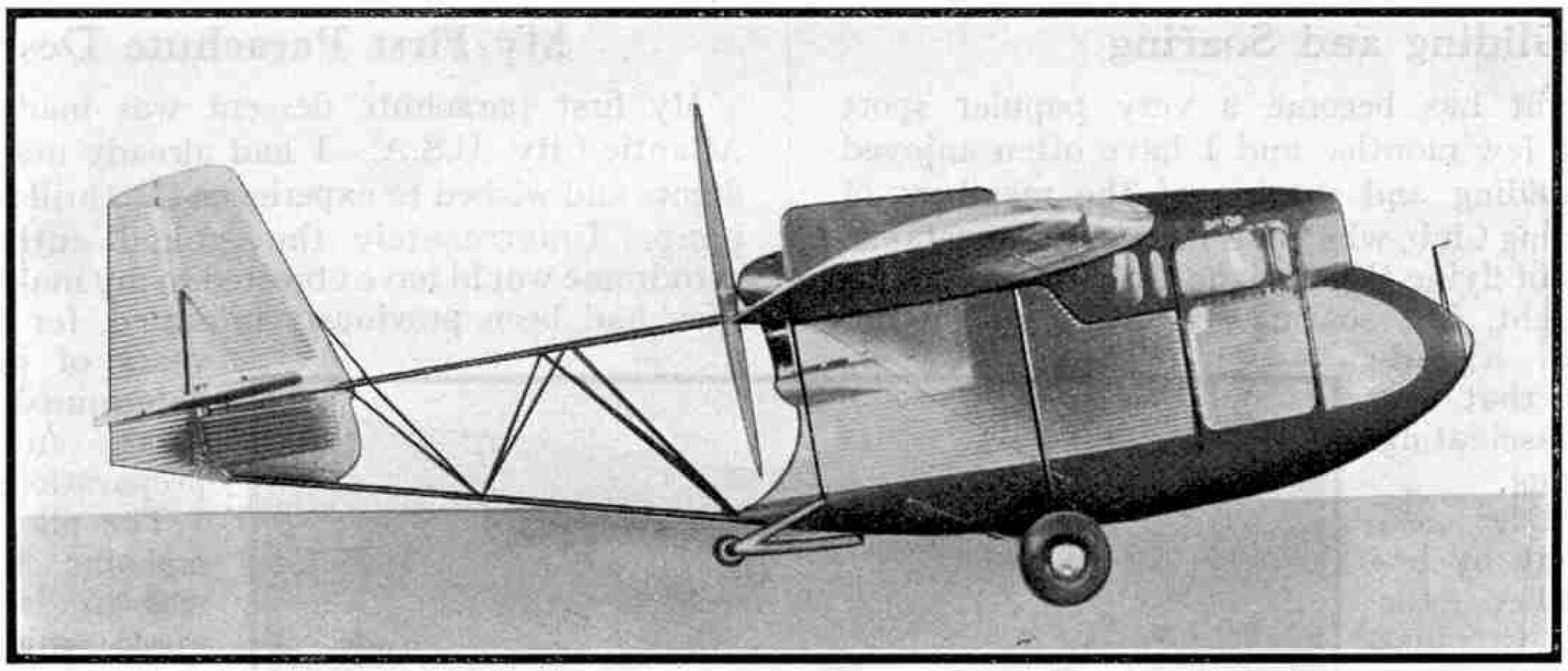
Probably the most unusual aeroplane at present in regular production is the Cierva "Autogiro." This machine was fully described and illustrated on page 362 of the "*M.M.*" for May, 1931. The four thin planes or rotors that take the place of the wings are mounted above the fuselage. They are caused to revolve by the passage of the machine through the air and continue their rotation until a landing has been made. During a flight they are always turning at a sufficiently high speed to provide the required lift and therefore the machine cannot stall and crash.

The rotors provide 80 per cent of the total lift of the "Autogiro." The result of this is that the machine can take off with a run of only 30 ft. and it may drop through the air practically vertically on landing. If his engine fails during flight, the pilot of an "Autogiro" is thus able to land slowly and without danger on a patch of ground no larger than an ordinary garden or lawn, even if this

is surrounded by trees and buildings.

Another type of machine that has been designed with a special view to safety is the Handley Page "Gugnunc," the chief feature of which is a very low stalling speed. This is not strictly an unusual aeroplane, perhaps, for it is an ordinary light aeroplane fitted with Handley Page automatic slots, but as our photograph of the machine shows, it certainly behaves in a very unusual manner. It is capable of climbing at an angle that is almost startlingly steep, and presents a remarkable spectacle when taking off after the comparatively short run that is necessary, for it almost appears to leap into the air.

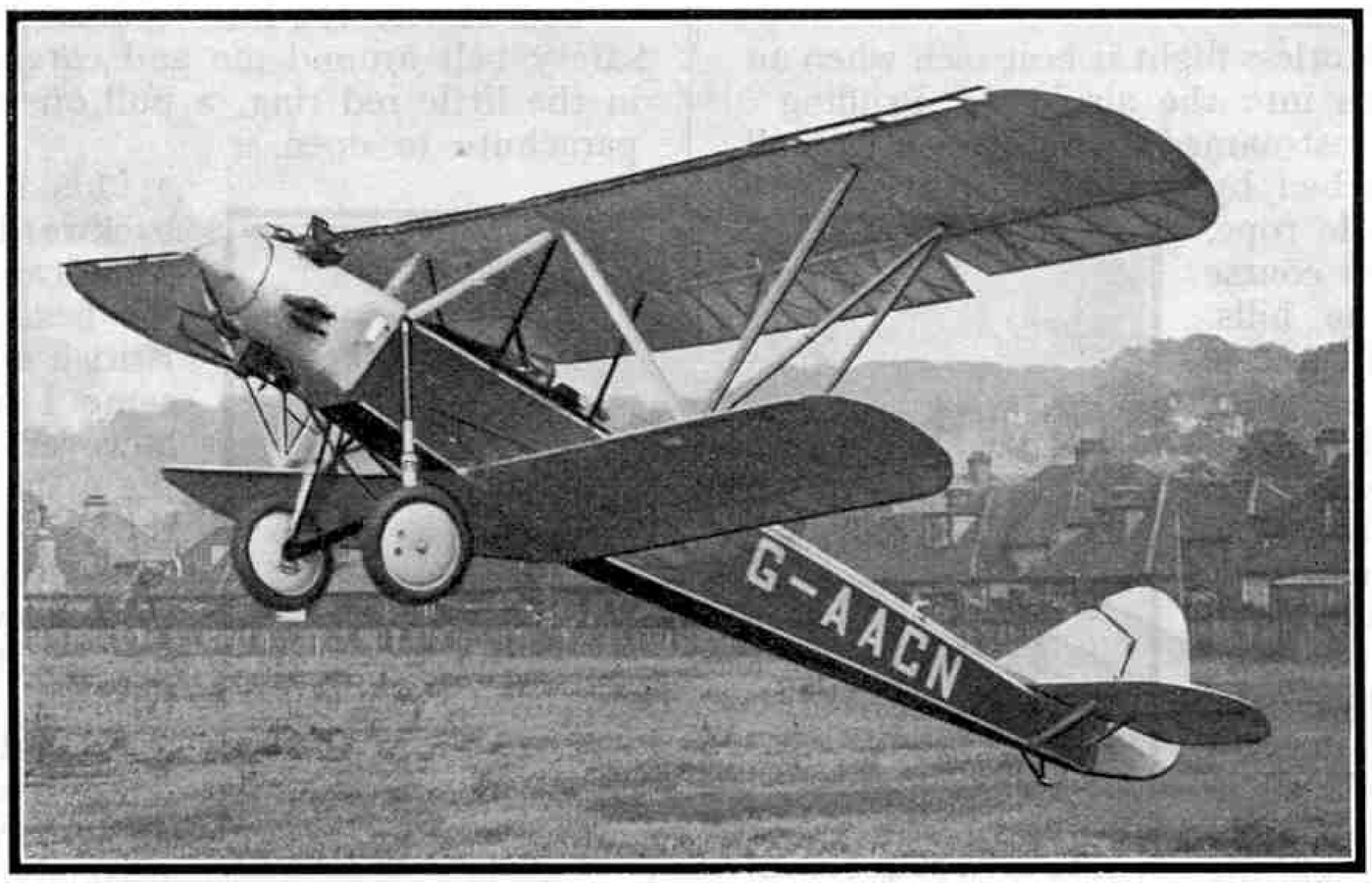
The Handley Page "Gugnunc" is a two-seater single-engined sesquiplane. Literally this means a machine with one-and-a-half wings, and it is so described because the lower of the two has a considerably shorter span than the upper one. The actual span of the upper wing of the "Gugnunc" is 40 ft., which is 12 ft. longer than the span of the lower wing. Both planes are built of wood and have coverings of the usual doped fabric. The upper wing is placed in advance of the lower one, giving what is called a "positive stagger." Both slope upward from the fuselage to their tips, and thus have what is termed a dihedral angle, an important factor in producing stability. Ailerons are fitted only on the upper plane.



A side view of the Stout "Sky Car," which was shown for the first time at the National Aircraft Show, Detroit, this year. This photograph is reproduced by courtesy of the Editor of "The Aeroplane."

The most remarkable features of the "Gugnunc" are the automatic slots that enable it to give such an excellent performance. These are hinged flaps fitted to the leading edge of the upper plane. These open when the wing of the machine makes an angle with the horizontal that in a normal aeroplane would lead to stalling owing to a disturbance of the smooth flow of air and the development of eddies. The passage of the airstream through the gap thus formed restores the flow, and with it the lifting power of the wing. Thus the use of slots enables a machine to climb at steeper angles than are possible for one not fitted with them.

The slots of the "Gugnunc" are arranged in three sections, the lengths at the two ends working independently of that in the centre. The centre slot is connected to a flap at the trailing edge of the wing in such a manner that when it is opened the rear flap is pulled down. This has the effect of further increasing the lift. The outer slots open first, the pull of the rear flap slightly delaying the action of that in the centre, and thus the lateral stability of the machine is assured.



The Handley-Page "Gugnunc" taking off at a steep angle at Cricklewood Aerodrome. We reproduce this illustration by permission of the Editor of "Flight."

The "Gugnunc" cannot land vertically, or pull up so readily as the Cierva "Autogiro," of course, but its stalling speed is only 33½ m.p.h. and it has a landing run 82 ft. in length. Its take off run measures 290 ft. in length. The machine has a maximum speed of 112½ m.p.h. and thus it has the excellent speed range of 79 m.p.h. At a height of 1,000 ft. its rate of climb is 730 ft. per minute, a figure that compares favourably with that of the average light aeroplane, which usually is about 500 ft. per minute.

A very interesting effort to produce an aeroplane that cannot stall was begun in 1924 by Captain G. T. R. Hill, a British designer. His machine took the form of an aeroplane without a tail. The idea was first tested by means of a glider. Later this was fitted with a 30 h.p. Bristol "Cherub" engine, and the first flight was carried out in November, 1925. In the air the machine bears a striking resemblance to a type of lizard, called the "Pterodactyl," that lived in prehistoric times. These creatures had fingers on their wings. It was because of this feature that they were given their name, for "pterodactyl" comes from the Greek *pteron*, meaning a wing, and *dactylas*, a finger. They varied greatly in size, some of them being no larger than sparrows and others being giants with a wing spread of more than 20 ft. from tip to tip. They had bird-like heads and sharp teeth, but no feathers, their wings consisting of leathery membranes stretching from front limbs to the back limbs.

The resemblance of Capt. Hill's "Pterodactyl" to the prehistoric flying lizard is largely due to the manner in which the wings are swept back from the fuselage to end in comparatively narrow tips. This form of construction gives a shape that in plan roughly resembles the head of a blunt arrow. The designer's purpose in adopting this unusual formation was to keep the centre of pressure of the machine in practically the same place in all conditions, whether the machine is made to climb steeply, or is flying on an even keel.

The first public flight of the "Pterodactyl" was made at the R.A.F. Display at Hendon in July, 1926. Its apparently clumsy evolutions in the air gave rise to great amusement, and it was described as "a huge moth making a noise like a mowing machine." Serious observers realised that the apparent clumsiness of the "Pterodactyl's" movements were really a demonstration of the machine's remarkable safety.

Experiments made since the introduction of the machine have led to numerous improvements, and a new type of tail-less aeroplane is now being constructed by the Westland Aircraft Works. The Westland Hill "Pterodactyl" is a monoplane of the pusher type, and in its latest form is fitted with an Armstrong Siddeley "Genet" engine developing 75 h.p. Particular attention also has been directed to improving the ground qualities of the machine, and a novel type of undercarriage has been developed in which the wheels are placed in tandem, instead of being side by side as in ordinary aeroplanes. One advantage of this type of undercarriage is that the machine cannot nose over, even if the wheels are locked, and wheel brakes may therefore be used with confidence. Side supports are fixed to enable the machine to rest in a normal position when stationary on the ground. These are fitted about halfway between the fuselage and the wing tips.

One of the peculiarities of the "Pterodactyl" is that it does not employ ailerons of the ordinary type. Instead it has twin "controllers." These are pivoted wing tips arranged in such a manner that, no matter what may be

(Continued on page 576)

Gliding and Soaring

Motorless flight has become a very popular sport during the last few months, and I have often enjoyed watching the gliding and soaring of the members of the London Gliding Club, which has its base at Dunstable. Gliding consists of flying through the air with continuous decrease in height, but soaring, or rising in the air with the aid of a sailplane, is an art that can be even more fascinating than power flying.

The type of glider used almost exclusively by beginners is called the "Zögling." At first sight this seems to be a very queer combination of wires and struts and one scarcely envies the would-be pilot, who is perched precariously at the very front of the main spar, his feet pressed against the rudder bar and his hands clutching the joystick. A flight in a glider usually is little more eventful than a toboggan run, but there are times when an undignified landing is made in the branches of a tree or even on a haystack.

A scene at a Gliding meeting. The sailplane being towed back to the hills after landing.

The fascination of motorless flight is best seen when an experienced pilot climbs into the air in a "Prüfling" or a "Professor," the last-named being the best of all sailplanes. He is launched by means of a tough elastic rope, and banks steeply to course along the ridge of the hills. Often he gains in height and is able to continue his flight as long as the breeze holds.

A glider is silent except for the whirring of the wind past the struts, and it seems incredible that a heavy machine is able to maintain itself in the air with no apparent source of energy. The hillside provides the solution, for the upward current produced by the rush of wind up its slope gives the necessary lift. By skilfully manipulating his controls, a pilot makes the best use of this current both for soaring and for forward movement.

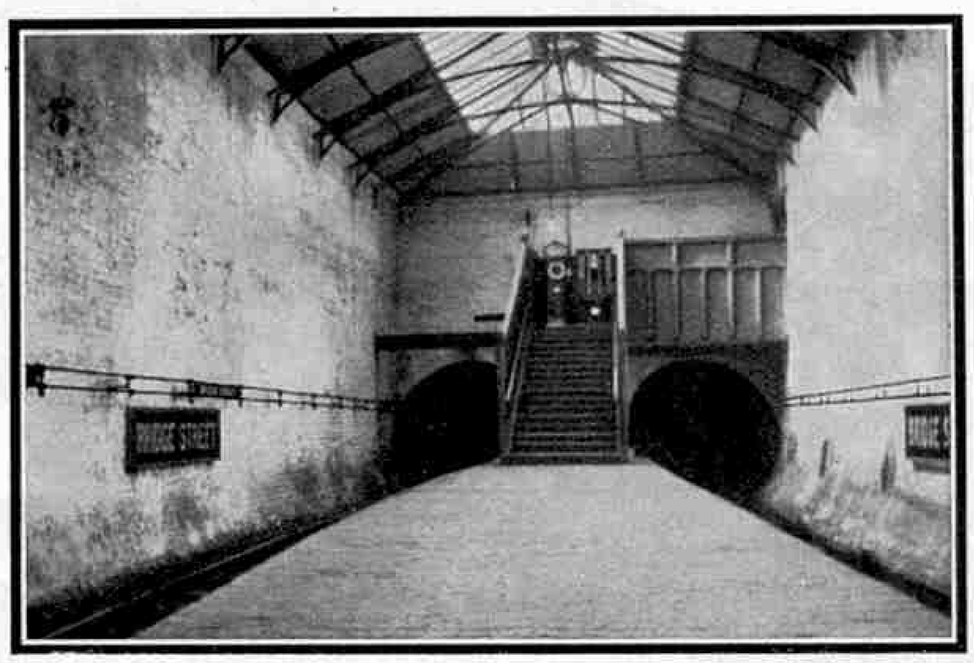
In view of the growing popularity of gliding and soaring, it seems certain that the present season will produce wonderful performances, especially if cloud soaring is attempted, for really skilful pilots may reach great heights by making use of upward air currents near cumulus clouds.

A. M. JOHNSTON (Dunstable).

My First Parachute Descent

My first parachute descent was made last year in Atlantic City, U.S.A. I had already made several solo flights and wished to experience the thrills of a parachute jump. Unfortunately the ground authorities at the aerodrome would have objected to my making a descent if they had been previously informed, for I was only 15 years of age, but I was determined to make the effort and carried on preparations in secret.

The pilot of the Curtiss machine from which I was to drop had himself made many parachute descents, and before we left the ground told me exactly what I should do. He decided that I should not leave the aeroplane until we had reached a height of about 3,000 ft. I felt a little nervous as we climbed into the sky and it seemed to me that we reached the necessary height far too soon. I climbed reluctantly out of the sheltered cockpit and noticed for the first time how hard and how far away the earth seemed to be! It was too late to draw back, so I strapped the safety belt around me and carefully hooked my finger in the little red ring, a pull on which would cause the parachute to open.


A station on the Glasgow District Subway. The conductor rails for electric lighting current may be seen on the walls. (See next page).

I had intended to carry out the backward jump practised by American fliers in preference to the head-first dive adopted by British airmen. When the time came I forgot all about style, however, and simply fell out of the machine. In my swift dive through space I remembered my instructions and after counting three slowly, tugged at the ring. Shortly afterward my downward progress was checked slightly and I realised that the pilot parachute had been released. After an interval that seemed surprisingly long I felt a terrific jerk. The main parachute had opened, and I was swinging in space.

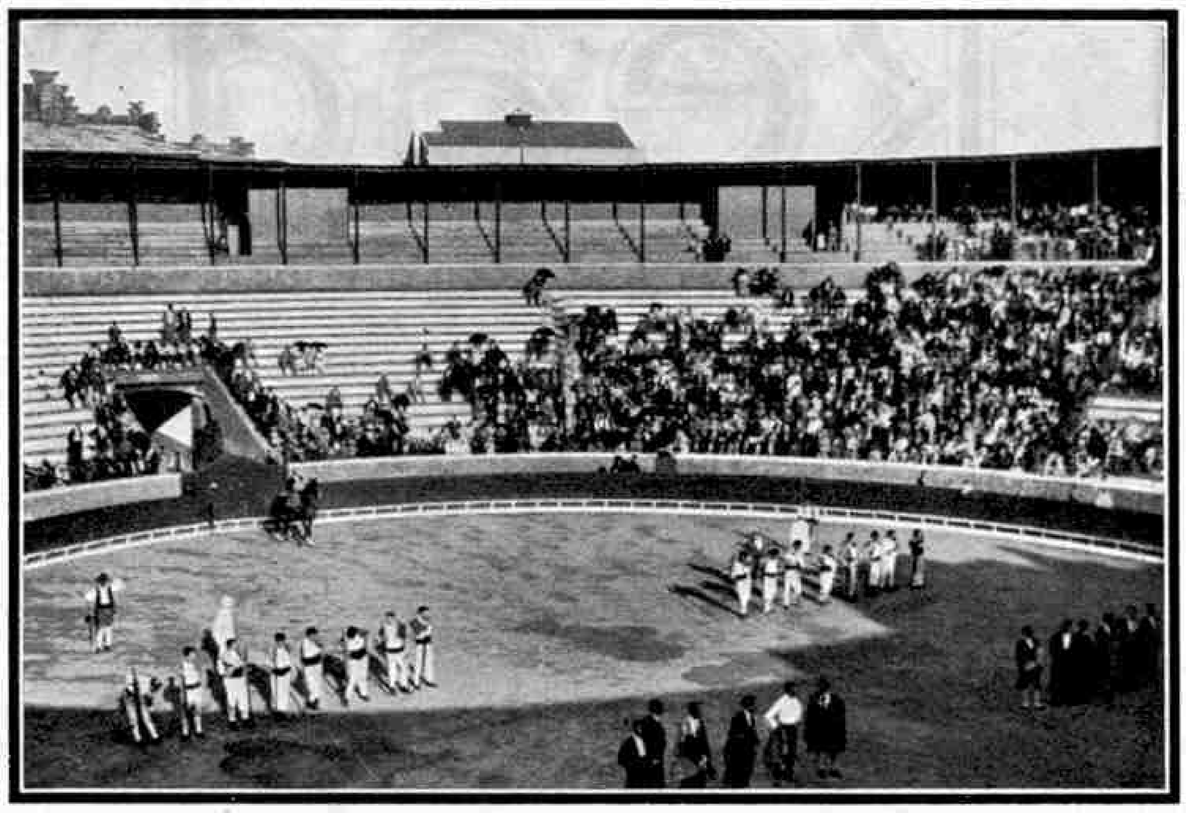
When I had recovered from the first thrill I began to look around me and had plenty of time in which to survey Atlantic City and the surrounding countryside. My gentle glide downward ended with a terrific thud, for I struck an apple tree, with the result that I was scratched and heavily bruised while the canopy of the parachute was slightly torn.

R. N. THORNE (Wembley).

A Bull-Fight in Portugal

While spending a summer holiday in Portugal I visited Algés, where I saw a bull-fight. The ring in which this took place resembles a circus. It is about 120 ft. in diameter, and its tiers of seats holds about 3,000 people. It has no roof and as the weather was hot during my visit, men selling water from large earthenware jars were kept busy, particularly on the sunny side of the arena.

Before the show started a small band played a stirring tune. Presently the bull-fighters paraded before us. These included the Forcadas, dressed in tight-fitting red and yellow jackets; the Picadores, who carried large red cloaks; and the Bandarilheiros, who were distinguished by velvet suits and three-cornered hats. Lastly came the Cavalleiro, who was riding a very spirited horse.



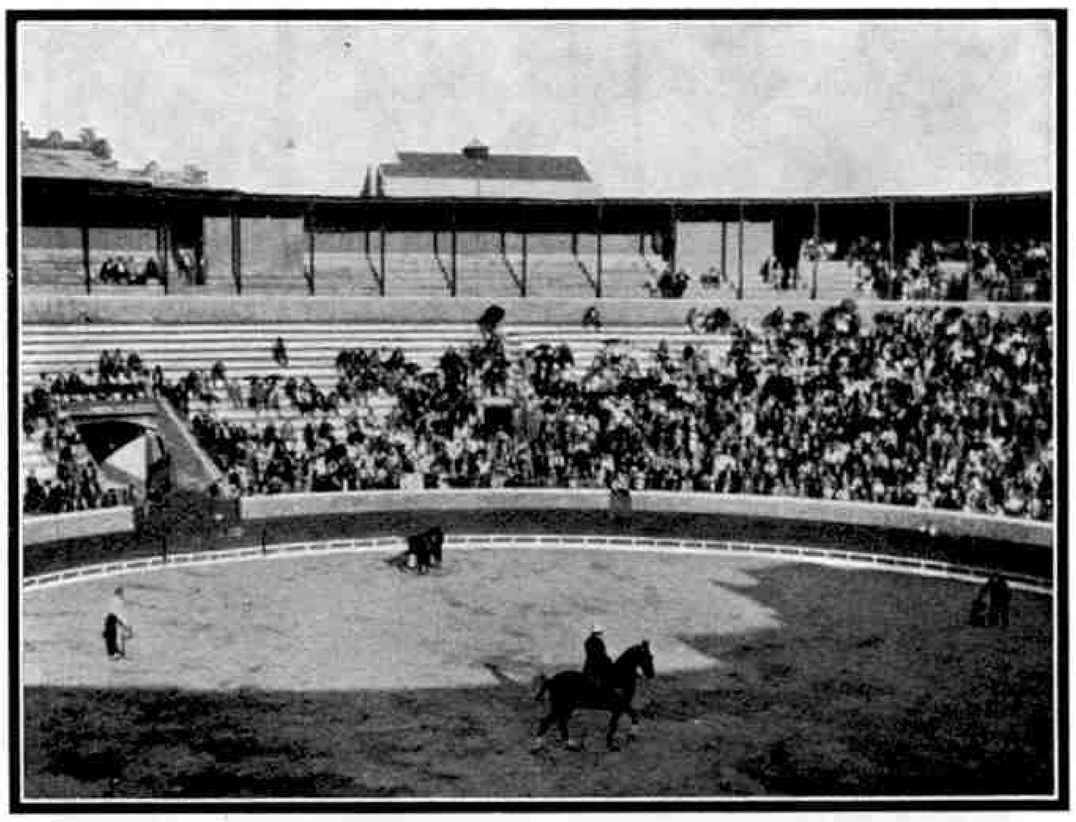
In the bull ring at Algés, Portugal. The fighters are parading before the performance begins, the Cavalleiro bringing up the rear.

The actual performance was begun by the Cavalleiro after a few ceremonial rides round the ring. He was given a wire dart attached to a thin stick, about 15 in. in length, that was decorated with coloured paper streamers. A door was opened in the wall of the arena. From this a bull emerged and charged straight at the Cavalleiro, who skilfully dodged it. Time after time the horseman eluded the onslaught of the bull and at last careered round and round the ring with the animal in close pursuit. Then he rose in his stirrups and leaned over to plant his dart in the fleshy part of the bull's neck. He repeated this performance until he had placed eight darts in position.

The Forcadas then came into the ring and slowly approached the angry bull. When charged, one of the men jumped on the animal's head, grasping the horns, and in this position was carried round the ring. The others pursued the bull, catching him by the tail, climbing on his sides and wrestling with him.

The fight had only been in progress ten minutes, but now the bull was quietened by driving in ten tame oxen, and in their company he left the ring. A new bull was introduced, but this time the dart planting was carried out by two Bandarilheiros. They tried to place their darts simultaneously on opposite sides of the bull's neck. This is risky and great excitement is caused when one of the men is charged, and vaults over the barrier only a second or two before the pursuing bull crashes into it.

The entire performance lasts about three hours, during which ten bulls are brought into the ring. Judges undertake the duty of preventing foul play or cruelty. The tiny darts do not appear to hurt the bulls, and it will be seen that in a Portuguese ring the men simply try their skill against that of the animal. A. G. NORE (Cardiff).



Another bull fight scene in the Algés ring. The bull is about to charge the Cavalleiro. Two Picadores with their large red cloaks also may be seen.

The Glasgow District Subway

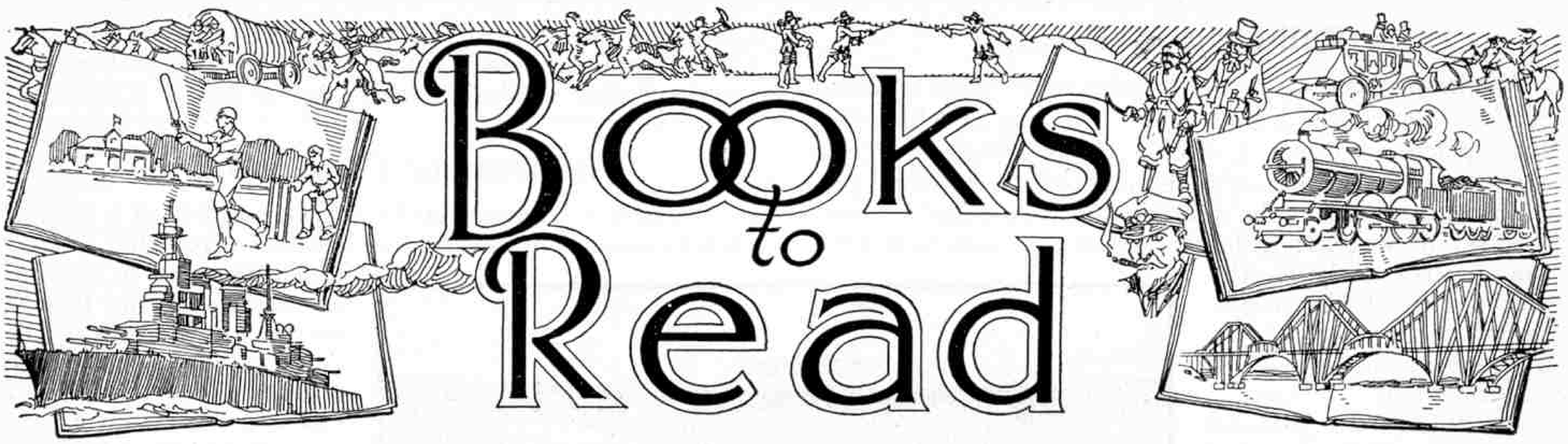
Glasgow's Underground Railway consists of a pair of tracks carried in two endless parallel tubes that form a circle 6½ miles in circumference under the busiest section of Glasgow. The subway varies in depth from 7 ft. to 115 ft. below street level, and it passes beneath the Clyde. It has no sidings or inclined planes by means of which the trains may be brought to the surface, and vehicles in need of repair have to be lifted through an opening in the roof for transference to a workshop that is 20 ft. above rail level.

In each tube is an endless wire rope that is employed for hauling the trains. This cable is carried on sheaves fixed in the centre of the track, and a strong vice or gripper is pressed into contact with it when a train is to be set in motion. Stopping is effected by lifting the gripper from the rope and applying the Westinghouse air brake.

It will be seen that the trains travelling in one direction are practically coupled to each other, for they are hauled by means of a single cable. Thus the trains on downward slopes help to pull those that are climbing upward gradients. The usual speed is 12 m.p.h., but at rush times the cable is speeded up to a maximum of 15 m.p.h. The coaches are illuminated by means of electric lamps, current for this purpose being taken from conductor rails fitted to the walls of the tunnel.

A first journey on the Glasgow District Subway is novel, if not particularly exciting. In order to gain access to the station platform it is necessary to pass through gloomy corridors and down flight after flight of dingy stairs. The rumble of the cable a few inches beneath the feet of the passengers, and the scraping of the collector shoe on the conductor rail, make conversation difficult while travelling, and the din is frequently accompanied by fearful bangs and thuds, the origin of which I have never been able to discover.

Travel is cheap, for a complete round of the system costs only 3d. The coaches provide seating accommodation for 42 people. A scheme for improving the appearance of the stations is now being considered in the hope of attracting more passengers. J. THOMAS (Glasgow).



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/– should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"Athletes In Action"

By F. A. M. Webster
(John F. Shaw (1928) & Co. Ltd. 6/– net)

The present-day athlete cannot hope to attain success on the lines that were adopted until comparatively few years ago. If he relies entirely on his physical strength and endurance and natural aptitude, he will inevitably be beaten by opponents whose natural equipment is no better than, if as good as, his, but who have been thoroughly trained on scientific principles. Unfortunately a large proportion of young athletes cannot secure the services of a skilled and experienced coach, and "*Athletes In Action*" has been written to provide a substitute. The author, Mr. F. A. M. Webster, was honorary chief coach to the British Universities Team of 1930, and was English javelin throwing champion in 1911 and 1923. He has had a wide and in some respects unique experience of athletics, and in this book he draws upon his stored-up knowledge with very valuable results.

Practically every important branch of athletics is dealt with—sprinting, distance running, high and low hurdles, high jump and long jump, the pole vault, putting the shot, and throwing the hammer, the javelin and the discus. Each branch is treated separately, with detailed instructions of what to do and what not to do, and is illustrated with action photographs. These photographs form a really remarkable series. They have been chosen with great skill to represent every important point dealt with in the text, and many of them show clearly details that probably would never be observed by the eye. The author says that he intends that the athlete should take this book with him to the training ground and try to imitate the attitudes shown in the photographs and carry out the instructions in the text. We feel confident that anyone who follows out this advice seriously will make steady progress. The writing is simple; the author has no fads or fancies; and the book is of value to all who wish to attain success in athletics, at school or elsewhere.

"Smith of Birkenhead"

By H. A. Taylor. (Stanley Paul. 12/6)

This book tells us the story of the auctioneer's son, born on 12th July, 1872, in a small house in Pilgrim Street, Birkenhead, who rose in meteoric fashion to be Lord High Chancellor of England, High Steward of Oxford University, and Secretary of State for India.

The Swing-Over—F. R. Webster, Bedford School. Public Schools Record Holder, 10 ft. 5 ins. (from "Athletes in Action," reviewed on this page).

F. E. Smith's schooldays were marked by many successes, but in 1885, when he was 13 years of age and "left school," he received one of the few setbacks of his career when he entered for an examination for a scholarship at Harrow and failed. Although the failure must have been a great blow to the boy's pride, it was no doubt a valuable experience for never again did he fail in any educational test. Perhaps he was referring to this solitary failure when, at the 1926 prize distribution at Birkenhead School (to which he passed after failing for Harrow), he said: "While you are young cultivate the habit of industry. I regret that I never did so. I can speak with the knowledge of experience of the value it would have been to me had I cultivated the habit when I was your age."

After the Harrow Scholarship examination, young Smith applied himself with great diligence to his work. He won an open Scholarship at University College, Liverpool, the winning of which had become a necessity with the untimely death of his father, if he was to achieve his ambition of an Oxford education. In the same year out of 5,655 boys examined for the Cambridge locals, Smith secured fourth place in all England for Latin. He also took special prizes for English Literature, Modern History, and French, at the Birkenhead School. These successes were followed by many others and finally he obtained an open scholarship for four years at Wadham College, Oxford.

At Oxford he became known as "Don't-care-Smith," a nickname that stuck to him ever after. He was a good amateur boxer and an all-round athlete, and on one occasion, when 21 years of age, he undertook for a wager a non-stop walk from Birkenhead to Llandudno, a distance of 60 miles, which he covered in fourteen hours at an average speed of 4¼ miles per hour. Later, he played Rugby and tennis in which latter game he retained a keen interest until the time of his death.

In his early days the future Lord Chancellor had little else than his hopes and ambitions, and life was a great adventure. It is these times, when the fight raged most fiercely, that seem to be more interesting than the days when the battle was won. He was elected to Parliament in 1906 and his maiden speech in the House of Commons made him famous in a night. As a barrister, and the youngest K.C. and bencher of his time, he became leader of the young Tories. During the War he saw service in France, was recalled to be appointed Solicitor-General, then Attorney-General, and later the youngest Lord High-Chancellor of modern times. Subsequently he was appointed Secretary of State for India—and all this before his 53rd birthday! He became a standard authority on international law, wrote a

score of books, and was a very enthusiastic yachtsman.

When he was raised to the peerage in 1919, he chose for his crest the Latin motto "*Faber meae fortunae*," which may be translated as "The Smith of my own Fortune," thus hinting with pride that he had fashioned a splendid career by his own efforts.

To read the life of this remarkable man—remarkable as a scholar, lawyer, politician, statesman, judge and author—cannot fail to interest every one of our readers and to each and all of us his career is an inspiration.

"The Land of the Sun God"

By H. Rydh. (George Allen & Unwin. 12/6)

Although the author is a noted archæologist, her book is written from the point of view of the ordinary visitor. The strange and delightful features of Ancient and Modern Egypt, and the adventures that befell the authoress during her stay in that country, are described in a manner that enables us to appreciate the powerful attraction of the mysterious land of the Sun God.

Of all the wonderful places in Egypt there can be few more attractive than the Valley of the Tombs of the Kings. Here one can walk from one rock tomb to another among the burial places of the Royal Pharaohs and their wives. On the walls of these burial chambers are unending scenes from the Book of the Dead, that "sure guide and protector of the departed," offering us a clear description of the Ancient Egyptian idea of the deceased's new life and giving us valuable information concerning the life he had just left.

In the Tomb of Seti I, where these pictures are especially beautiful, the visitor walks through six or seven galleries hewn out of the solid rock, and everywhere reads of death's mysteries until at last he comes to the chamber that contained the Pharaoh's alabaster coffin, which is now in London.

Among the several other tombs visited and described is that of Tut-ankh-amen, the prince who died when he was 17 or 18 years of age and was carried to his everlasting rest with unheard of pomp and supplied with an equipment of fabulous magnificence. The treasures of Tut-ankh-amen's tomb have now been removed to the Museum at Cairo, where there is always a long queue and a constant stream of visitors. The chief attraction is the coffin of pure gold with the features of the young Pharaoh reproduced as a life-like gold mask, the forehead adorned with a cobra head, the distinctive emblem of Pharaonic majesty and a diadem of extraordinarily beautiful workmanship.

Of far greater importance to the expert even than the coffin of gold, however, are three insignificant little iron articles—a dagger, a tiny cushion, and an eye. They are the most ancient specimens of iron work that have been found in Egyptian excavations and they have a place of great importance in the history of civilisation. As Dr. Rydh points out: "If we consider the importance of iron in the world's development, and of Egypt's influence on Europe as pioneer at that early date, we see plainly that every such find as may determine the date of the first appearance of iron in Ancient Egypt is of great interest from the point of view of the history of human progress."

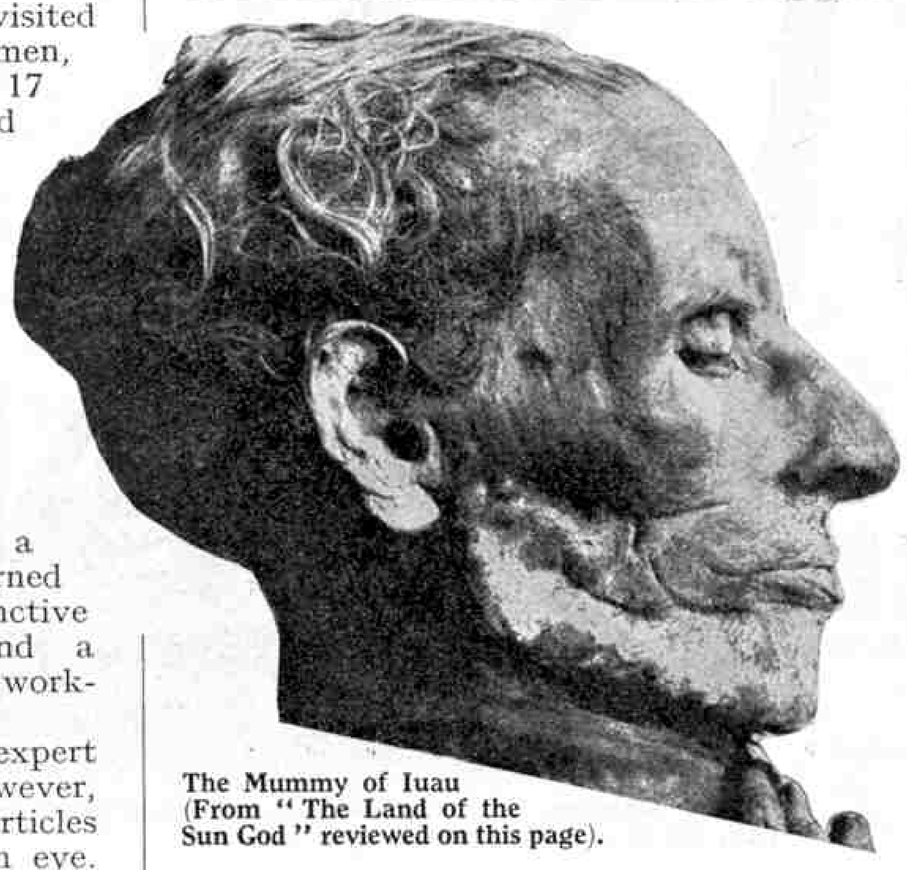
The Colossi at Memnon near Thebes. These enormous statues, each weighing 1,200 tons, were hewn out of a solid block of sandstone and transported many miles by water to their present position. (From "The Land of the Sun God" reviewed on this page).

The book is easy to read and is well illustrated with numerous photographs.

"Airmanship"

By John McDonough
(Pitman & Sons Ltd. 7/6 net)

This book has been written primarily for young pilots and students of aviation living in Canada, where conditions differ widely in many respects from those in Great Britain. In Northern and Eastern Canada, for instance, landplanes are not often seen, for during the summer most of the flying is carried out in seaplanes, and during the winter all machines are fitted with landing skis. Nevertheless the book should be of interest and value to British students.



The Mummy of Iuau (From "The Land of the Sun God" reviewed on this page).

The author has had the benefit of an extremely wide experience of flying, having been actively engaged in aviation since 1917, when he joined the Royal Flying Corps. After the War he was employed as an air mail pilot in the United States, and later he was given a commission as instructor in the R.A.F. After leaving the R.A.F. he was chief instructor with the Midland Flying Club, Birmingham, for two years, and he is now employed with Northern Aerial Mineral Explorations Ltd.

"*Airmanship*" commences with a brief exposition of the elementary theory of flight, and notes on flying clothing and physical fitness. It then passes on to practical matters, and the general method of flying an aeroplane is briefly explained. The tests for pilots' licenses also are dealt with, but as only those in operation in Canada are mentioned the information is not of much value to the British reader. On the other hand, the section dealing with airmanship on the ground is distinctly valuable. A chapter dealing with advanced flying training is included, and finally there are hints on summer and winter operations, which of course have reference mainly to Canadian conditions.

The book is well illustrated by photographs showing various phases of aviation in Canada. There are also many interesting drawings, especially those that illustrate methods of determining the direction and speed of the wind by observing the ripples on lakes, and the angles at which the "wind socks," or wind-direction indicators, flown at all aerodromes, are fluttering.

"The Prison Breakers"

By Alban M. Philip. (Philip Allen. 5/-)

Here is a book that will delight the hearts of many boys, for in it are recounted some of the most hazardous escapes and attempts at escapes on record. We are thrilled to read of the adventures of John Nevison, the dashing highwayman who escaped from Leicester Gaol; of Jack Sheppard, whose fabulous exploits are well-known; of David Haggart, the Scottish thief and murderer, who escaped four times; of Louis Cartouche, a brilliant rogue who gained the upper hand of the Paris Police; of Louis Napoleon, the details of whose flight from Ham are not as well known as they should be; of Frederick Trenck, who failed in his great attempt to tunnel the Star Fort at Magdeburg.

As the author points out in his Preface, there is a great deal to be admired in the man who makes a thrilling escape from prison. He has those greatest of all gifts—courage and imagination; and he has the spirit to put his daring to the test. The odds are always against him and he knows that he may have to pay the penalty for failure with his life. To hold up a stage coach or rob a man on the highway calls for little courage—the robber takes care that the odds are always in his favour—but to plan and carry out single-handed and unarmed a task that seems impossible to other men shows a spirit of enterprise and an indomitable courage that will always call forth admiration (though it be of the "sneaking" kind) from those who read the stories of their adventures!

Interesting New Books

The undermentioned books, recently published, will be reviewed in a future issue.

"British Aircraft"
by C. A. Sims (A. & C. Black Ltd. 3/6)

"The Pacific"
by Stanley Rogers (G. G. Harrap & Co. Ltd. 7/6)

"On the High Seas"
by Keble Chatterton (Philip Allan & Co. Ltd. 3/6)

"Across Three Oceans"
by Conor O'Brien (Philip Allan & Co. Ltd. 3/6)

"A Boy Scout with Byrd"
by Paul Siple (Putnam's Sons Ltd. 6/-)

New Meccano Models

Drummer—Flying Boat—Sheerlegs—Diesel Engine—Aircraft Gun—Skier

THE introduction of the Meccano No. 000 Outfit, and the great popularity of the "Simplicity" Model-building Contests, have centred interest on models that can be built with very few parts, and some very ingenious examples have been produced recently.

Models built with the small Outfits cannot of course compare as regards size and detail with those constructed with the more advanced sets, but the limited number of parts available makes it essential that each part should be used in the most skilful manner possible.

Much fun can be had from devising original uses for the parts, and in arranging them in different combinations to form new models.

This month we illustrate four new examples of the type of model just mentioned, all built with a No. 000 Outfit. Among these the Drummer shown in Fig. 1 and the Ski-ing Meccanitian, Fig. 6, are particularly interesting and amusing. In addition to these "simplicity" models we include two more advanced examples of Meccano construction, a realistic model Sheerlegs, and an imposing reproduction of a Doxford type Diesel Engine.

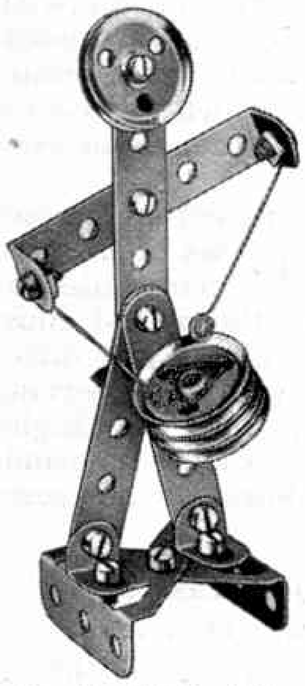


Fig. 1. A jolly little Meccano Drummer Boy.

The Meccano Drummer Complete with Drum and Sticks

The jolly little drummer shown in Fig. 1 looks very smart in his "green and gold" uniform, and complete with drum and drum sticks! The assembly of this small musician will be seen from the illustration.

The drummer's body consists of a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, and an Angle Bracket is secured to this to support the 1" loose Pulley forming his head. His drum consists of three 1" loose Pulleys bound together with a length of cord, the ends of which are secured to his body. Each of his drum sticks consists of a short length of copper wire, one end of which is secured under the bolt placed at the extremity of one of his arms (a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip). The other end of the wire should be bent into a flat spiral with a pair of pliers, to represent the "head" of the stick.

As will be seen, few parts are needed for the drummer. They are:—2 of No. 5; 3 of No. 12; 4 of No. 22a; 10 of No. 37; 1 of No. 40; 2 of No. 48a; 2 of No. 126; Short length of Copper Wire.

Model Dornier "Do.X" Flying Boat

The model flying boat shown in Fig. 2 is intended to represent the Dornier "Do.X," the six nuts and bolts secured to the main wing of the model doing duty as the multiple engine nacelles of the actual machine! The model is very simple to build and its construction will be quite clear from the illustration.

The Flying Boat contains the following parts:—2 of No. 2; 2 of No. 5; 2 of No. 10; 4 of No. 12; 12 of No. 37; 2 of No. 126.

Electrically-operated Sheerlegs

The hoist motion of the model Sheerlegs shown in Fig. 3 is operated by a Meccano 6-volt Electric Motor.

Steam power is generally employed in machines of this type, and in order to increase the realism of the model a dummy boiler and steam cylinder have been added. Of course, those model-builders who possess Meccano Steam Engines will be able to dispense with this "camou flage" and use the boiler and cylinder unit of their Engines for generating power for the hoist motion.

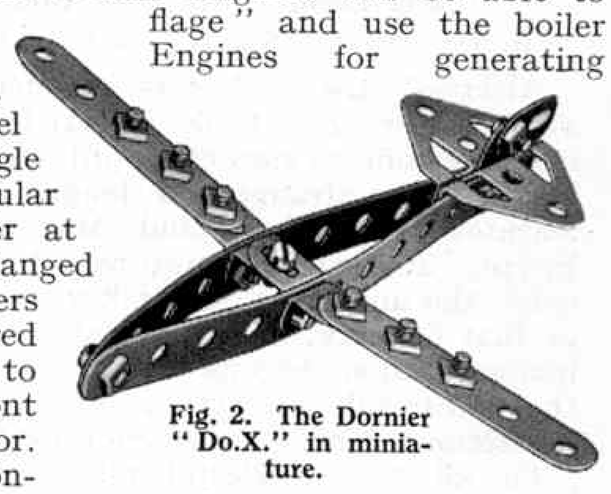


Fig. 2. The Dornier "Do.X." in miniature.

The base frame of the model consists of three $12\frac{1}{2}''$ Angle Girders arranged in triangular formation and held together at the apex by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. Two $5\frac{1}{2}''$ Angle Girders are overlapped and secured between the $12\frac{1}{2}''$ Girders, to provide a support for the front portion of the Electric Motor. The fixed jib of the model consists of four $12\frac{1}{2}''$ Angle Girders, and the jib is held in place by a double tie member consisting of four $12\frac{1}{2}''$ Strips.

The fixed pulley block at the top of the sheerlegs consists of a Cranked Bent Strip carrying two 1" loose Pulleys. The Cranked Bent Strip has a small Fork Piece secured to it by a $\frac{3}{8}''$ Bolt, which passes through the hole in the bottom of the Cranked Bent Strip, and is held in place by a $1\frac{1}{2}''$ Rod 1. The hoist barrel consists of a $3\frac{1}{2}''$ Axle Rod mounted in the perforations in the Electric Motor side plates. The hoist cord is wound round this, and is then passed over one of the 1" Pulleys at the top of the jib. It then passes round the 1" Pulley of the hook block and round the second pulley at the jib head, finally being secured to a Flat Bracket attached to the hook block.

The Sleeve Piece forming the cylinder is free to turn about the Rod 2, on which it is held in place by means of two Collars, one on the inside and one on the outside of the Sleeve Piece. The piston rod is fitted with an End Bearing that is attached to the flywheel by a Pivot Bolt. A Collar is placed between the End Bearing and the face of the 3" Pulley for spacing purposes.

The Sheerlegs contains the following parts:—4 of No. 1; 1 of No. 5; 7 of No. 8; 4 of No. 9; 1 of No. 10; 5 of No. 12; 1 of No. 16; 1 of No. 17; 2 of No. 18a; 1 of No. 19s; 1 of No. 19b; 2 of No. 20b; 3 of No. 22a; 1 of No. 26; 2 of No. 27a; 4 of No. 35; 36 of No. 37; 6 of No. 37a; 9 of No. 38; 1 of No. 40; 1 of No. 44; 1 of No. 52; 1 of No. 57; 9 of No. 59; 2 of No. 111; 1 of No. 111c; 1 of No. 116a; 2 of No. 126a; 1 of No. 147b; 1 of No. 162; 2 of No. 163; 1 of No. 164; 1 of No. 166; 1 Electric Motor.

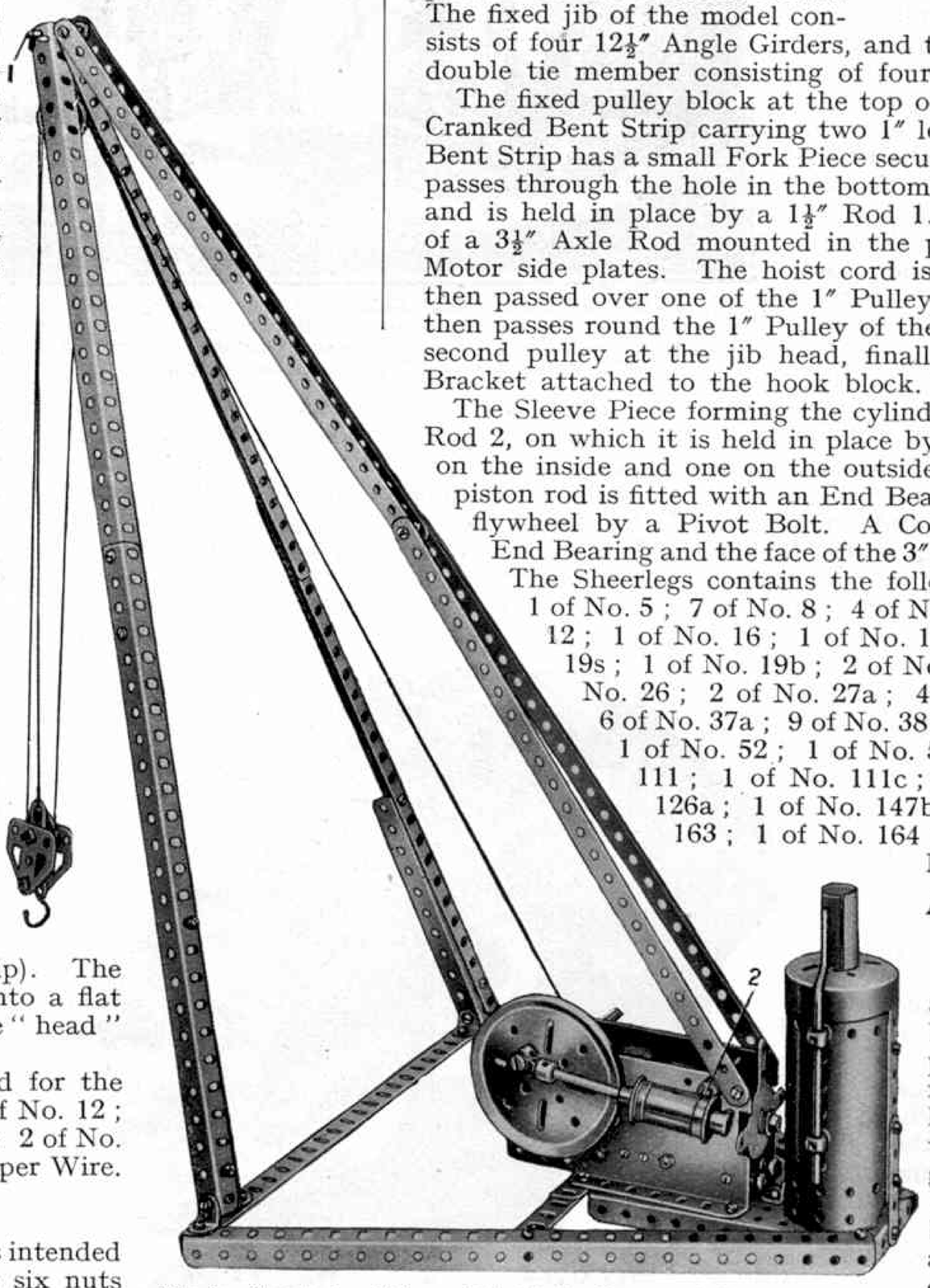


Fig. 3. Sheerlegs. This model is fitted with steam boiler and cylinder unit, but is actually operated by a Meccano 6-volt Electric Motor.

A Miniature Anti-Aircraft Gun

The model shown in Fig. 5 uses very few parts indeed; but in spite of this it possesses quite a good resemblance to the well-known type of air-defence weapon. The body of the gun consists of two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, bolted together at one end, and held in place at the other by the $3\frac{1}{2}''$ Axle Rod forming the barrel, the Axle being kept in position by means of two Spring Clips. The Double Angle Strips are pivoted on two bolts placed in vertical $2\frac{1}{2}''$ Strips forming the swivelling standard. An Angle Bracket is slipped on to the shank of each bolt to provide a bearing for a vertical $3\frac{1}{2}''$ Axle about which the standard pivots. Two Angle Brackets are bolted to the lower ends of the $2\frac{1}{2}''$ Strips and the vertical axle is passed through them, being held in place by means of two Spring Clips secured on either side of the base plate.

The parts used in the construction of the model gun are:—

2 of No. 5 ; 1 of No. 10 ; 4 of No. 12 ; 2 of No. 16 ; 4 of No. 35 ; 5 of No. 37 ; 1 of No. 48a ; 1 of No. 52.

The Ski-ing Meccanitian

We have christened the amusing Fig. 6, "Ski-ing Meccanitian" but from the illustration it would appear that he is not "ski-ing" at all, and is actually about to make contact with the ground in very unpleasant fashion! The Skier's body consists of a $2\frac{1}{2}$" Strip while two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips secured by Angle Brackets serve as legs. His arms are built up from a $2\frac{1}{2}$" Strip and two Flat Brackets, while a 1" loose Pulley secured by means of a bolt (his nose) provides him with a very "expressive" face. He is equipped with an excellent pair of skis ($5\frac{1}{2}$" Strips), and the ski-ing sticks that he holds are composed of $3\frac{1}{2}$" Axle Rods fitted with 1" loose Pulleys. The Pulleys are held in place by means of short lengths of cord bound round the Rods above and below the Pulleys.

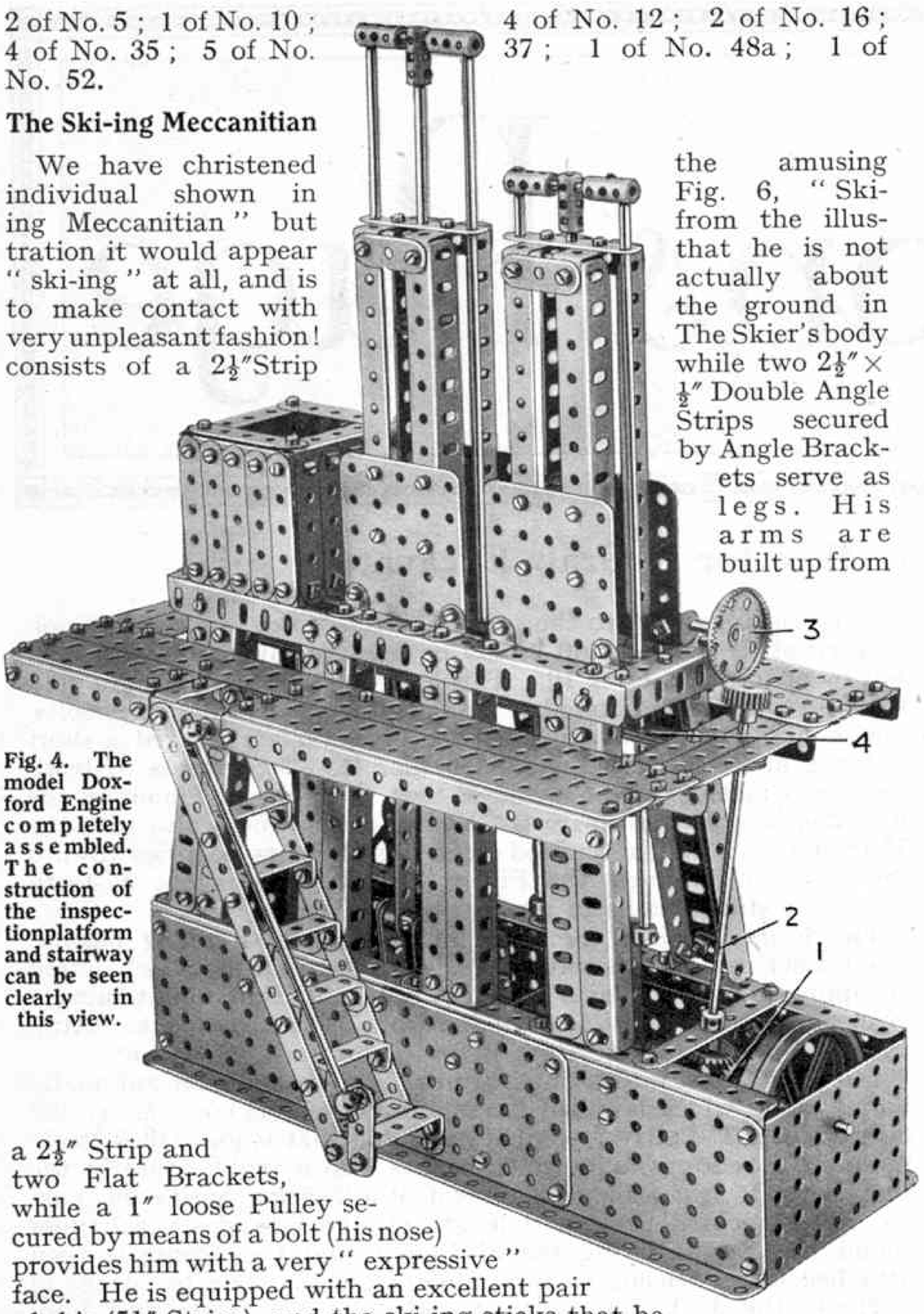


Fig. 4. The model Doxford Engine completely assembled. The construction of the inspection platform and stairway can be seen clearly in this view.

In order to build the Ski-ing Meccanitian the following parts will be required :—2 of No. 2 ; 2 of No. 5 ; 3 of No. 10 ; 2 of No. 12 ; 2 of No. 16 ; 3 of No. 22a ; 4 of No. 35 ; 10 of No. 37 ; 2 of No. 48a ; 1 of No. 52.

Doxford Type Internal Combustion Engine

One of the latest engines working on the Diesel principle is the Doxford engine, which is fitted with two pistons working in each cylinder, three cranks being used for each set of pistons and connecting rods. An extra crank is provided for the scavenging piston, whose job it is to force a blast of air through the cylinders and thus remove any products of combustion remaining in the cylinder after each power stroke.

The model shown in Figs. 4 and 7, is an accurate reproduction of this type of engine, all the movements of the prototype being faithfully reproduced. Each side of the engine bedplate consists of two $12\frac{1}{2}$" Angle Girders and three $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flat Plates, which are bolted together as shown in Fig. 7. When completed, the two sides are joined together by two $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates. The $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips, which form the bearings for the crankshaft, may now be fitted. The side standards, $5\frac{1}{2}"$ Angle Girders, are secured at the top to two $9\frac{1}{2}"$ Angle Girders joined together by $2\frac{1}{2}"$ Angle Girders. The $9\frac{1}{2}"$ Angle Girders form a base to support the cylinders. The construction of the combustion cylinders will be seen clearly from the two illustrations. The scavenging cylinder is built up from a number of $2\frac{1}{2}"$ Strips and $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips.

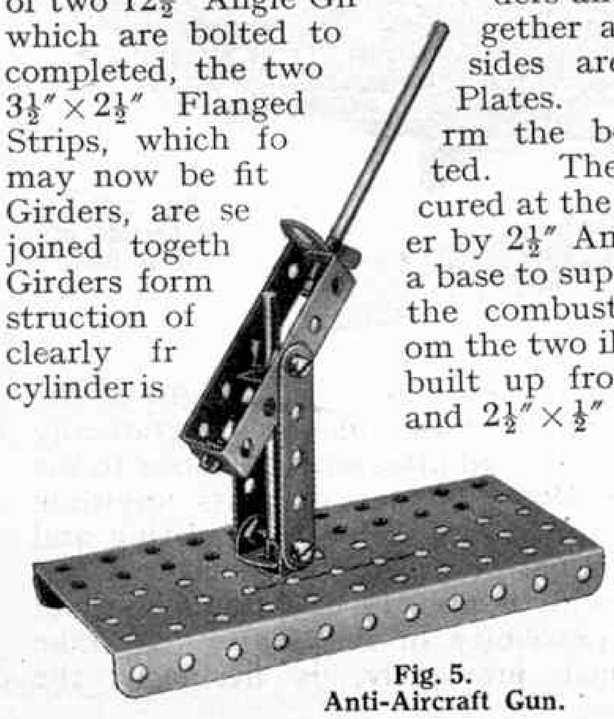


Fig. 5. Anti-Aircraft Gun.

The crankshaft is built up from fourteen Single Arm Cranks, two Double Arm Cranks, and four $2\frac{1}{2}"$ Strips, in the following manner. Two Cranks 9 are bolted together as shown in Fig. 7 to form one crank web, and to this is attached, by means of a 1" Rod, a second web 10 constructed in a similar manner to the first, except that a $2\frac{1}{2}"$ Strip is used for lengthening purposes. These two webs are connected by a 1" Rod to two webs 11 of similar dimensions. A $3\frac{1}{2}"$ Strip is slipped on to each of the 1" Rods joining two webs together. A second set of three cranks is now to be built up and when completed should be journalled together with the first set, in the $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips mentioned previously. A scavenger crank 8 is fitted to the end of the crankshaft and is connected by a $3\frac{1}{2}"$ Strip to a piston Rod 15 to which a 2" Pulley is secured inside the cylinder to form a piston. The other end of the crankshaft carries a Flywheel and a $\frac{7}{8}"$ Bevel 1 that meshes with a second $\frac{7}{8}"$ Bevel on a Rod 2, which carries also a $\frac{3}{4}"$ Pinion driving a $1\frac{1}{2}"$ Contrate 3 on the camshaft.

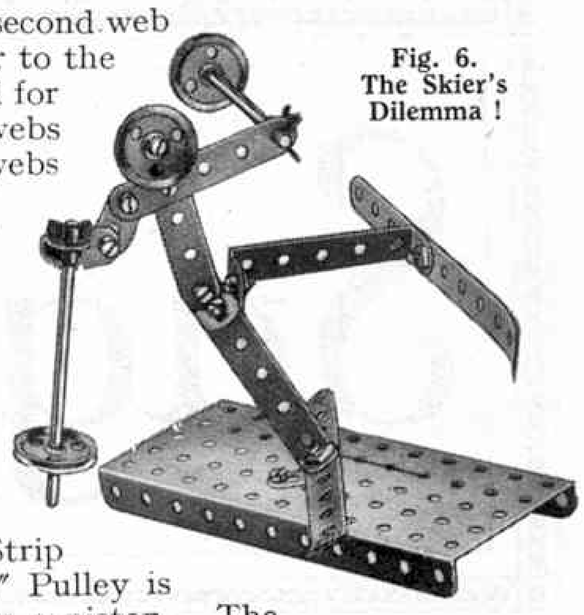


Fig. 6. The Skier's Dilemma !

Each of the upper piston rods carrying the piston heads 13 (1" Pulleys) is connected by Couplings in the manner shown to two $11\frac{1}{2}"$ Rods 14 which, in turn, connect with the cranks and connecting rods 12. These Rods slide in $2\frac{1}{2}"$ Strips placed across the tops of the cylinders, and also in two $12\frac{1}{2}"$ Strips 4 which are bolted to a raised platform secured round the engine in the position shown. The lower pistons and piston rods are connected to their respective connecting rods by means of End Bearings.

The valve regulating gear may now be constructed. A Bush Wheel 5, pivotally mounted on a Pivot Bolt secured to Flat Trunnion on the bed-plate, is connected to a Coupling 6 by two Threaded Bosses and a $4\frac{1}{2}"$ Threaded Rod. This Coupling is mounted on a $4\frac{1}{2}"$ Rod, together with a second Coupling that is connected by a 2" Strip to the Coupling 7, which operates the valve regulating rod.

In order to build the model the following parts will be required :—3 of No. 1 ; 2 of No. 1b ; 14 of No. 2a ; 34 of No. 5 ; 5 of No. 6a ; 7 of No. 8 ; 2 of No. 8a ; 1 of No. 8b ; 24 of No. 9 ; 1 of No. 9b ; 6 of No. 9d ; 9 of No. 10 ; 20 of No. 12 ; 4 of No. 13 ; 2 of No. 14 ; 3 of No. 15 ; 5 of No. 15a ; 1 of No. 16 ; 1 of No. 18a ; 7 of No. 18b ; 1 of No. 20a ; 4 of No. 22 ; 2 of No. 24 ; 1 of No. 25 ; 1 of No. 28 ; 2 of No. 30 ; 234 of No. 37 ; 10 of No. 37a ; 6 of No. 38 ; 12 of No. 48 ; 4 of No. 48a ; 4 of No. 48b ; 2 of No. 53 ; 11 of No. 59 ; 16 of No. 62 ; 9 of No. 63 ; 2 of No. 64 ; 4 No. of 70 ; 2 of No. 72 ; 1 of No. 80b ; 4 of No. 103b ; 2 of No. 103d ; 2 of No. 103k ; 4 of No. 111a ; 11 of No. 111c ; 1 of No. 125 ; 1 of No. 132 ; 2 of No. 136 ; 1 of No. 147b ; 3 of No. 166.

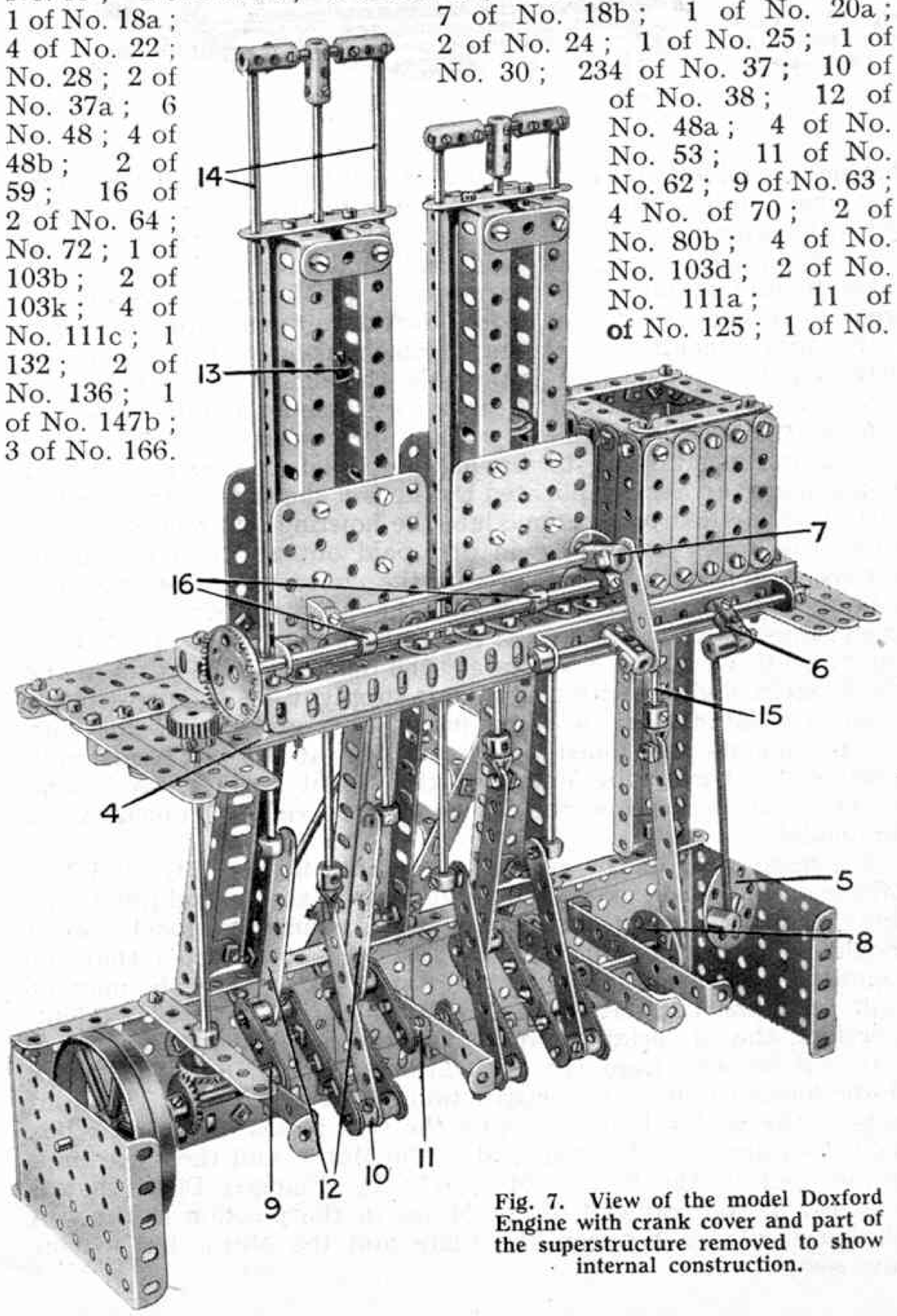


Fig. 7. View of the model Doxford Engine with crank cover and part of the superstructure removed to show internal construction.

Suggestions Page

(237)—Novel Four-Movement Gear Box for a Grab Excavator

One of the most interesting tasks to which a Meccano boy can devote himself is the designing of a gear box for a Meccano model of a crane or motor car. In a crane that has any pretensions to completeness there are the four separate movements of hoisting,

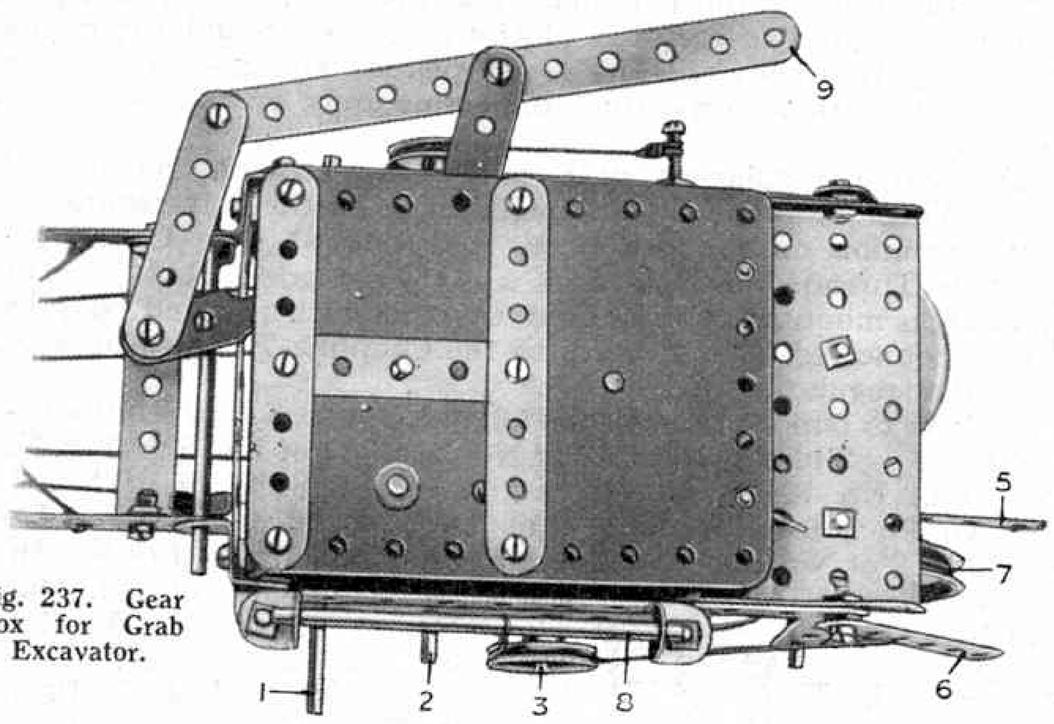


Fig. 237. Gear Box for Grab Excavator.

slewing, travelling and luffing, all of which have to be driven from one power unit. More than one motor may of course be used, but although this method simplifies matters considerably, and at the same time conforms with actual modern practice, it is not likely to find favour with the majority of Meccano boys on the ground of expense. Even some fortunate possessors of large outfits find difficult the devising of mechanisms of this nature, so they might well consider impossible the construction from the contents of a No. 3 Outfit of a gear box suitable for a grab excavator.

At first sight this judgment would appear correct, for most grab excavators, in addition to having the usual slewing and luffing motions, are further complicated by the fact that two extra winding barrels are needed to accommodate the hoisting and holding ropes. These two ropes are hauled in and paid out at the same speed, but when it is desired to discharge the contents of the grab, the holding rope barrel is braked and the hoisting barrel runs out freely, thus allowing the jaws of the grab to open. Two $\frac{1}{2}$" Pinions, one 57-teeth Gear and a Worm are the only available gears in the No. 3 Outfit, and yet with this meagre supply it has been possible to produce a satisfactory working model of a grab excavator with the movements mentioned. Unfortunately it has not been found possible to stretch the limits of the Outfit further, so "hand power" has to be resorted to for the travelling movement of the model.

A general view of the gear box is shown in Fig. 237, and Fig. 237a is an underside view of the unit to show the central pivot, etc. Boys who have more parts may improve on the model, but it should be borne in mind that it has been so designed that the complete excavator, including the truck, jib, and grab, may be built with the contents of a No. 3 Outfit. It will be evident, therefore, that a certain amount of detail has had to be omitted.

It will be seen from the illustrations that a No. 2 Clockwork Motor forms the basis of construction of the gear box. The front ends of the Sector Plates forming the side plates of the gear box are bolted direct to the front end of the Motor, and their rear ends are secured to the flanges of a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate that is attached to the rear end of the Motor in the position shown. A Washer is placed between the Plate and the Motor for spacing purposes.

A Worm is secured to the spindle of the Motor, and a $\frac{1}{2}"$ Pinion on each of the Rods 1 and 2 may be brought into mesh with it at will by operating a lever 10. This lever is mounted pivotally on a $1" \times 1"$ Angle Bracket bolted to the Sector Plate, and it carries bolts, the shanks of each engaging between two Collars secured a short distance apart on the Rod. A further Rod 3 carries a 57-teeth Gear, and matters are so arranged that when the $\frac{1}{2}"$ Pinion on the Rod 2 is fully in mesh with the Worm, it is in mesh also with the 57-teeth Gear. When the Rod is slid slightly in its bearings toward the observer however, the Pinion disengages from the 57-teeth Gear, but still remains in mesh with the Worm.

The Rods 2 and 3 comprise the hoisting and luffing barrels. The former pays out its cord as the latter winds in, by which action an approximation to level luffing is obtained, thus maintaining a level position of the load when the jib is luffed in or out. Strap and lever brakes 4 and 6 are provided for each movement.

One of the most interesting features of the model is the automatic barrel round which is coiled the holding rope. It consists, as will be seen, of a 3" Pulley 7 secured on a Rod that is journalled freely in suitable bearings, and which carries also a brake drum in the shape of a 1" fast Pulley. One end of a Tension Spring 7a (Part No. 43) is secured to a short length of cord wound several times round the Rod carrying the 3" Pulley, and the Spring is then attached under tension to the frame of the gear box by means of a Hook, the 3" Pulley being at the same time restrained from rotation. The holding rope is now attached to the circumference of the Pulley, and is passed over one of the jib head pulleys down to the grab head.

As the grab ascends, the Spring turns the Pulley and in so doing

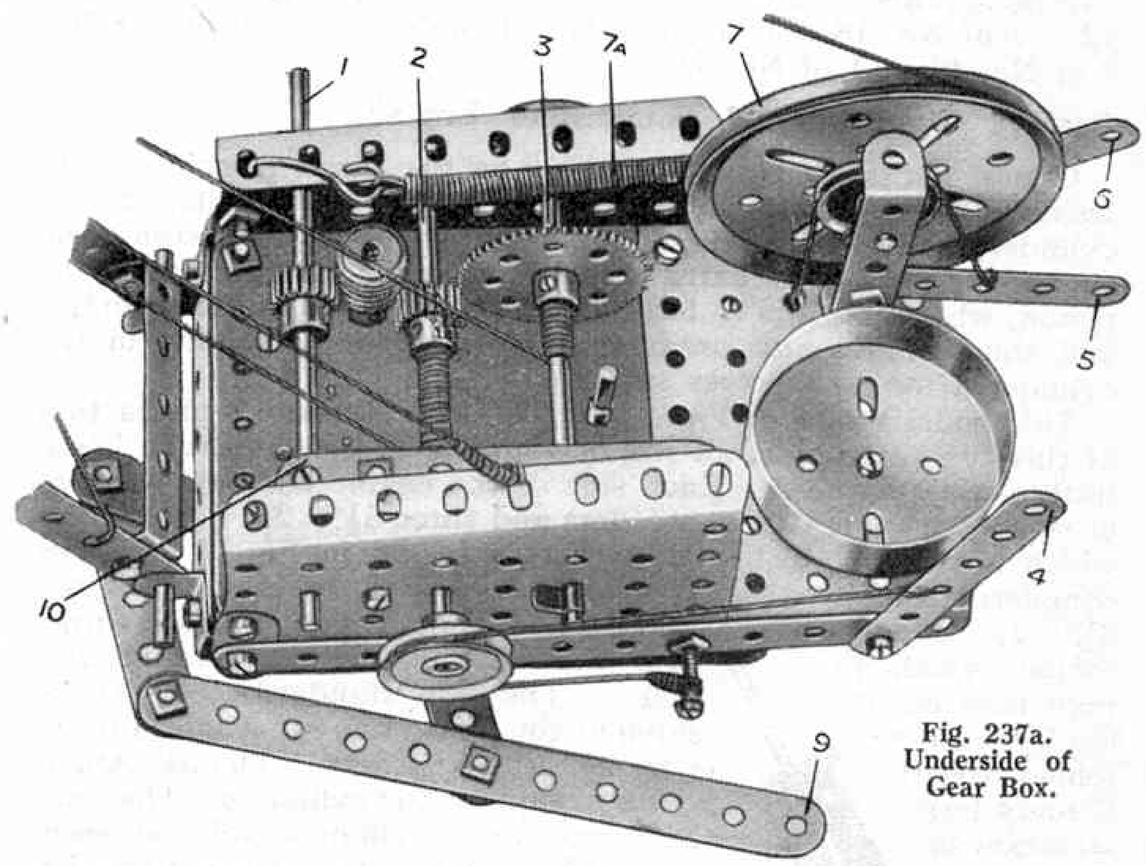


Fig. 237a. Underside of Gear Box.

winds in the holding rope; but in descending, the weight of the grab unwinds the holding rope from the Pulley against the gradually increasing tension of the Spring, the cord attaching the latter to the barrel being wound on to the Rod. Space prevents anything but a brief description of the method of fixing the hoisting and holding ropes to the grab. The hoisting rope should be attached to the Rod about which the jaws pivot, and the holding rope should be made fast to the upper extremity of the grab. A brake 5, similar to those mentioned previously, is fitted to the holding barrel shaft.

Turning now to the slewing arrangements, Fig. 237a shows that the pin about which the model slews is a Pivot Bolt, which is carried in a 2½″ Strip secured by Set-screws and nuts to two 3½″ Strips. The 3½″ Strips are attached to the underside of the Motor by means of ⅜″ Bolts, and are packed up by three Washers on each of the Bolts. The Pivot Bolt is secured in the boss of a 3″ Pulley that is bolted to the truck. The 3½″ Strips bear on the edge of this Pulley to form a bearing surface of large area, thus making the model noticeably free from wobble.

A length of cord is wrapped several times round the end of the Rod 1 and is passed over the Rod 8, being then taken twice round the groove of the 3″ Pulley on the truck before its ends are tied together. It will now be apparent that by an appropriate movement of the control lever 10 the Pinion on the Rod 1 will be brought into mesh with the Worm, which results in the model being slewed through the medium of the cord. Means are also provided for actuating the brake and reverse levers of the Motor by means of a single control 9, which is arranged in the manner indicated in Figs. 237 and 237a.

This device is similar in principle to Suggestion No. 55 (August 1926, "*M.M.*") and consists of a 5½″ Strip, the centre hole of which is attached pivotally by means of a lock-nutted bolt to the reversing lever of the Motor. One end of the Strip is also connected pivotally by a link to the brake lever. Hence it will be seen that by moving the lever sideways (when looking toward the front of the model) the brake of the Motor may be brought into play, and a "push-pull" movement results in reversal of the Motor.

A refinement may be added in the form of a vertical lever attached to the end of the lever 9 so as to make its control more convenient. The lever would have to be mounted so that it could be moved in every direction, but this should not prove a difficult task.

(238)—A Steam Hammer

(*J. Hodson, Sheffield*)

Steam hammers form a very important unit in the equipment of works engaged in the production of heavy machinery, for without their aid the forging of such parts as large crankshafts could only be undertaken with the greatest difficulty. In fact, it is doubtful if such jobs could be attempted with any prospect of success. Those of our readers who have had the good fortune to see one of these giant hammers forging a great mass of white-hot metal, must have experienced a feeling of awe not unmixed with fear, as the ground shivered beneath their feet and the sparks leaped high in the air under the titanic blows of the hammer. The control of the modern steam hammer is so delicate however, that it is possible to crack an egg in a wine glass without breaking the glass!

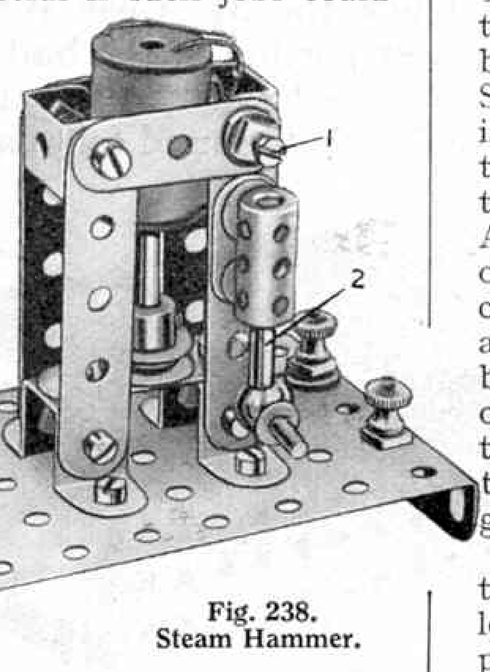


Fig. 238. Steam Hammer.

Fig. 238 illustrates an exceptionally neat model of a steam hammer, which depends for its operation on electricity. When a current flows through the turns of wire of the solenoid representing the steam cylinder, the Rod carrying the "tup" or hammer is drawn up, and as soon as the circuit is broken the tup drops.

The solenoid is a Meccano Bobbin (Part No. 301) wound to capacity with No. 26 gauge wire and mounted in the framework as shown in the illustration. Two terminals are mounted on the baseplate of the model, one of which is in metallic contact with the Plate and the other is insulated by means of an Insulating Bush and Washer. One of the ends of the solenoid winding is connected to the last-mentioned terminal, while the other end of the winding is attached to an insulated 6 B.A. Bolt 1 so that on sliding the Rod 2 upward into contact with it, the circuit is completed through the frame of the model.

(239)—Caterpillar Track in Meccano

(*J. Juson, London, S.E.19*)

The building of a satisfactory caterpillar track in Meccano is a problem that must have often faced Meccano boys in their model-building. Many types of excavating machines, as well as tanks, are mounted on this type of track, which enables a vehicle to travel easily over soft and rough ground.

The track illustrated in Fig. 239 is modelled on the lines of a Morris Roadless Tractor, an illustration of which appeared on page 292 of the April, 1931 "*M.M.*" The track consists of pairs of 2″ Strips clamped by ⅜″ Bolts to either side of two parallel lengths of Sprocket Chain. The track runs over a pair of 3″ Pulleys and a pair of 2″ Pulleys, the rims of the Pulleys fitting between the outer rows of ⅜″ Bolts, and four 1″ fast Pulleys are provided in addition to bear the weight of the vehicle. These Pulleys are secured to short Rods that are journalled in Flat Brackets bolted by their slotted holes to the arms of a Single Bent Strip. The Single Bent Strip is attached to a 1″ Triangular Plate fixed to a 2″ Angle Girder connecting together the sides of the containing frame. The 2″ Angle Girder forms a convenient means of attaching the unit to the body of the car. The track is excellent in many ways, and about the only objection that can be brought against it is the large number of Strips required to make a length of track, a fact which would militate against the construction of a model tank, on the grounds of expense.

Another method of making caterpillar track is to secure the Strips to parallel lengths of Sprocket Chain by means of paper fasteners of the split type. These fasteners consist of a head from which project long soft metal lugs. The lugs are passed through a hole in the Strip and through a link of the Sprocket Chain and they are then bent over in the manner of a Dredger Bucket Clip, so that the chain rides freely on the Sprocket Wheels.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.125). A Useful Water Motor.—J. Fraser, Glasgow, has succeeded in constructing with the aid of standard Meccano parts a water motor that is capable of driving small models, etc. The rotor or water wheel, consists of two Face Plates joined together by means of eight 1½″×½″ Double Angle Strips, each of which carries a Dredger Bucket. A Rod is passed through the bosses of the Wheels and the whole unit is mounted in a suitable frame. It is advisable to enclose the device in a casing in order to prevent splashing, and to this end a suitable housing may be constructed from Flat Plates or sheet tin. The latter is to be preferred as water would leak from the holes in the Plates.

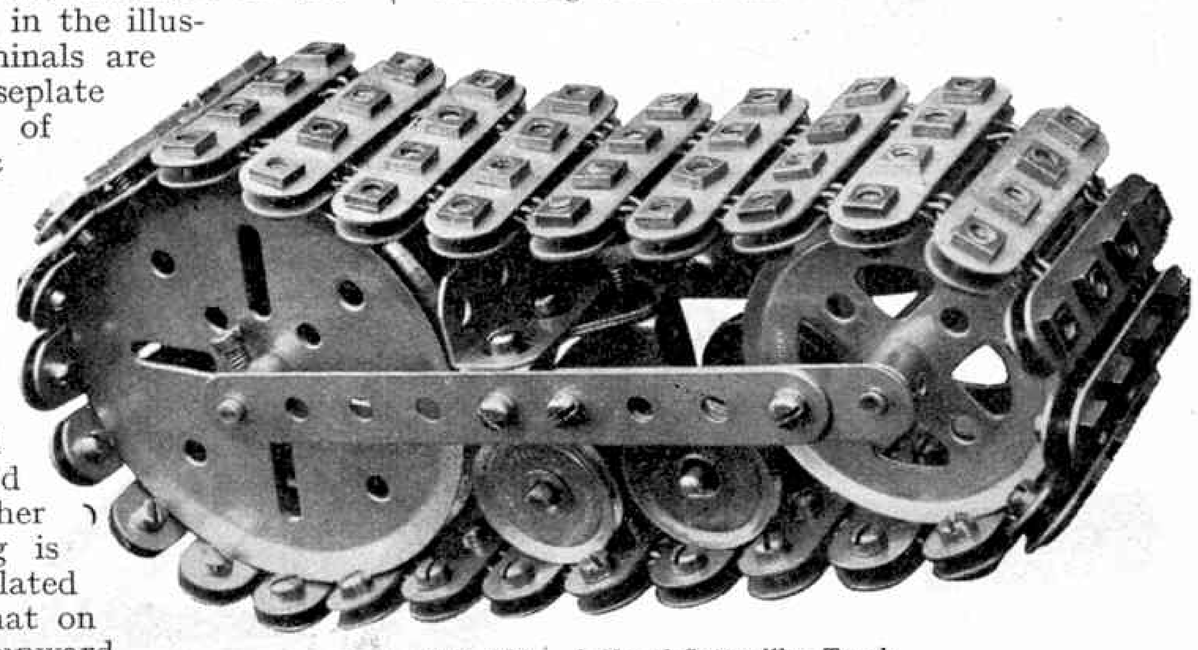


Fig. 239. A Novel Caterpillar Track.

The stream of water that provides the motive power for the model issues from a jet formed in the end of a short length of glass tubing, which is passed through a hole bored in a cork clamped to the casing in such a manner that the jet of water is directed into the Buckets. Careful adjustment of the jet and also of the angle of the Buckets is necessary if the model is to work in a reliable manner. The glass tubing is connected to the water tap by a length of rubber tubing.

(M.126).—A Meccano Tap.—A novel small tap made from a Threaded Boss is suggested by C. Lea, Birmingham. A Threaded Boss is soldered in the desired position in such a manner that its transversed tapped hole is vertical. The upper hole is plugged with a Grub Screw, and a ¾″ Bolt works in the longitudinal bore of the Threaded Boss so that by screwing the Bolt inward, its shank obstructs the transverse hole and thus prevents flow of the liquid. By turning the Bolt in the other direction the tap is opened. A convenient handle for the ¾″ Bolt may be formed from a Handrail Support.

(M.127).—Dust Cap for Motor Car Wheels.—In connection with Miscellaneous Suggestion No. M.102 (A Neat Wheel for Double Tyres), S. Davidge, London, N.16, mentions the fact that Remington Ribbon Spools cannot be used for this purpose as their overall diameter is too great to take 2″ Dunlop Tyres. The two discs forming part of the core of this type of spool make, however, excellent dust caps for built-up wheels. It should be remembered that extremely realistic disc wheels to fit the 2″ Dunlop Tyres may be formed from Boiler Ends.

New Meccan

Railway Breakd

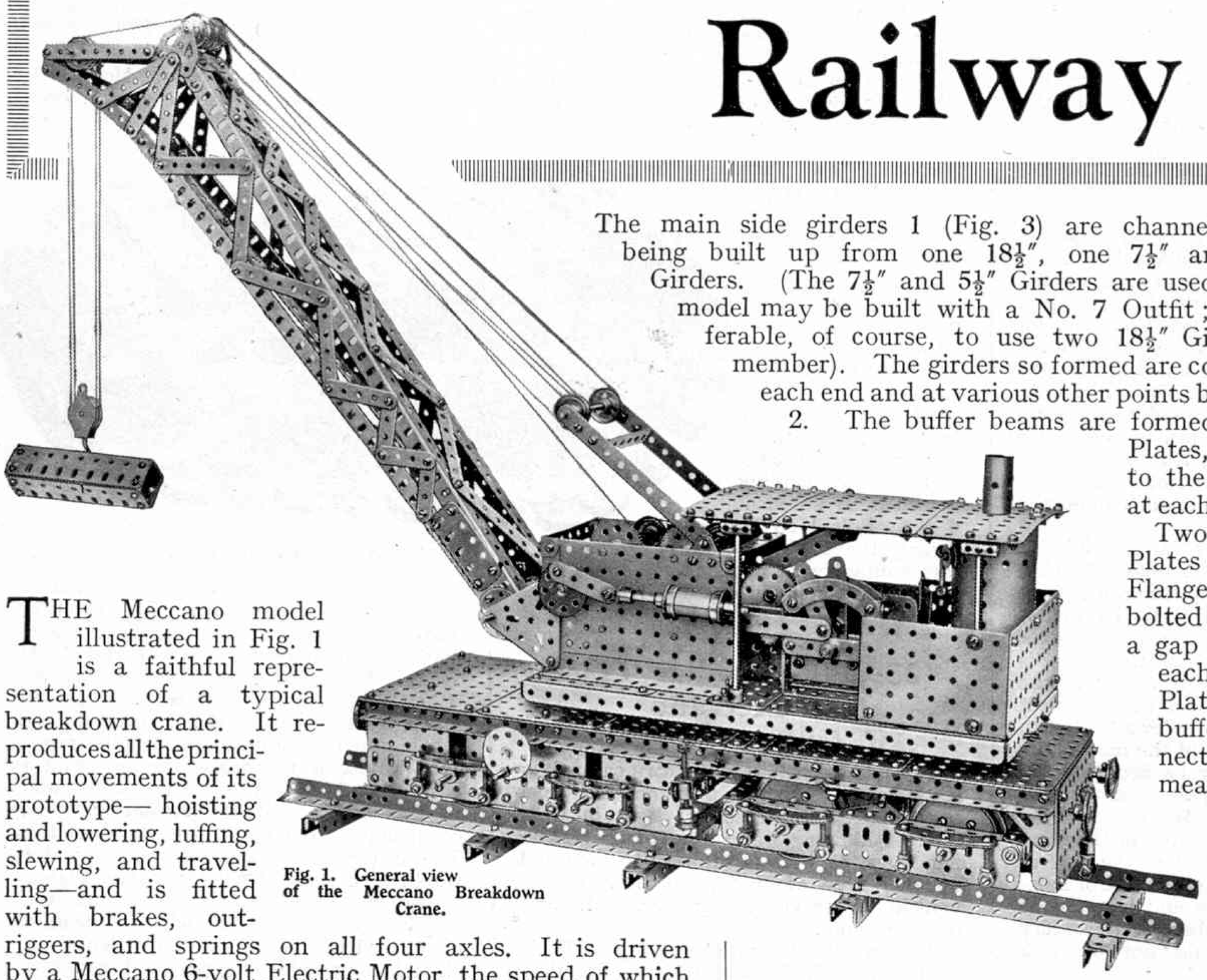


Fig. 1. General view of the Meccano Breakdown Crane.

THE Meccano model illustrated in Fig. 1 is a faithful representation of a typical breakdown crane. It reproduces all the principal movements of its prototype— hoisting and lowering, luffing, slewing, and travelling—and is fitted with brakes, outriggers, and springs on all four axles. It is driven by a Meccano 6-volt Electric Motor, the speed of which may be regulated by a built-up Meccano controller. As the actual crane is steam-operated, a dummy boiler and engine are incorporated in the model. The crane truck is about 20″ in overall length and is designed to run on 3″ gauge rails, which may of course be built up from Meccano Angle Girders, etc.

The constructional details of the model will be dealt with fully in two special articles, of which this is the first. The second article will appear next month. This article includes full details for building the crane truck, bogie, and wheel mechanism; and in the August issue we shall describe the swivelling superstructure, jib, gear-box mechanism, and a special type of resistance controller for regulating the Motor.

There are many Meccano boys who will want to build this model, not only for the pleasure to be had from its construction, but for the fun of working it when completed. By the touch of a lever the model may be made to roll slowly forward, or slew, luff, and hoist just like a real crane. With the aid of the numerous illustrations accompanying the articles, no difficulty should be experienced in building a successful model.

Construction of the Crane Truck

The construction of the model should be commenced by building the crane truck. As will be seen from Fig. 1 and the various sectional views (Figs. 2, 3 and 5), the truck is very solidly built and is complete down to the smallest detail.

The main side girders 1 (Fig. 3) are channel in section, each being built up from one 18½″, one 7½″ and two 5½″ Angle Girders. (The 7½″ and 5½″ Girders are used in order that the model may be built with a No. 7 Outfit; it would be preferable, of course, to use two 18½″ Girders for each side member). The girders so formed are connected together at each end and at various other points by 4½″ Angle Girders 2. The buffer beams are formed by 4½″ × 2½″ Flat Plates, which are attached to the 4½″ Angle Girders at each end of the girders 1.

Two 2½″ × 2½″ Flat Plates 5 and 3½″ × 2½″ Flanged Plates 6 are bolted to each girder 1, a gap being left between each Plate. The end Plates adjoining the buffer beam are connected to the latter by means of 2½″ Angle Girders, while the buffer beam at the other end of the truck is reinforced by 2½″ Angle Girders and Corner Brackets, the latter forming a rigid connection between the 2½″ Girders and the side members 1. A 9½″ Flat Girder 7 is bolted along the lower edges of the Plates on each side of the truck, and as there is a gap of one hole between the Plates, the slotted holes of the Flat Girder are unobstructed at this point. The purpose of this will be explained later.

The two 4½″ Angle Girders 3 form a rigid means of attaching to the truck the 3½″ Gear Wheel 4 (Fig. 2) which forms the lower portion of the ball race on which the model slews. It is attached to the truck by means of four ½″ Bolts, Collars being used for spacing purposes.

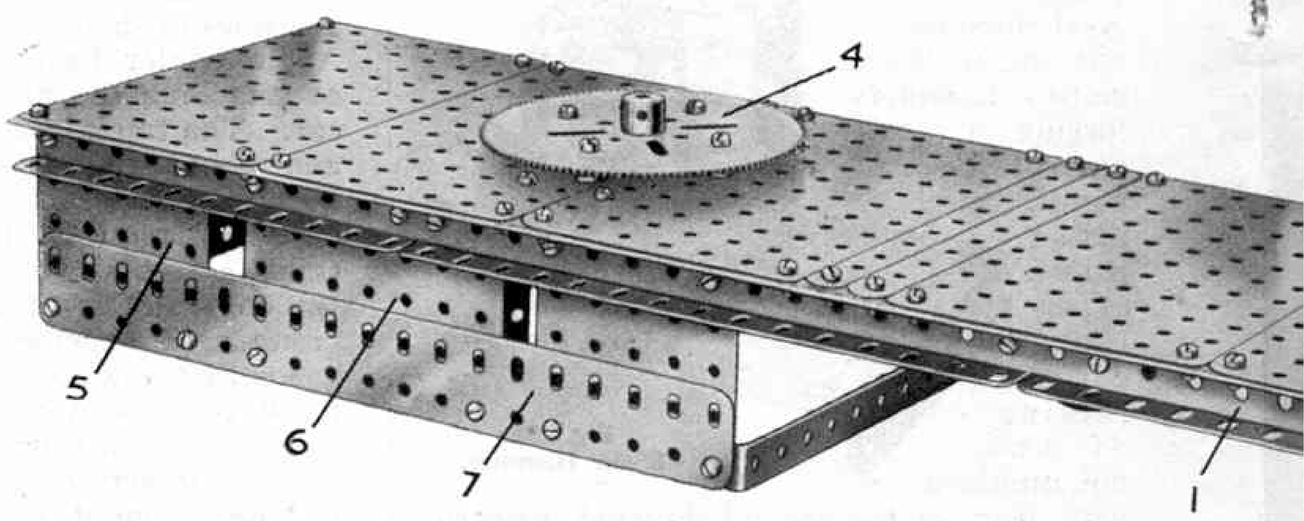


Fig. 2. Th Truck fra The Gear W forms the fixed portio Ball Bearir

A reinforced bearing 3a (Figs. 3 and 5), composed of a 1½″ Strip bolted to two 1½″ Angle Girders, is then attached to the Girders 3. Care should be taken to ensure that a Rod, when passed through the boss of

ccano Model akdown Crane

SPECIAL FEATURES

The various movements of the model, hoisting and lowering, slewing, luffing, and travelling, are all driven by a 6-volt Motor through a gear box of unique design. The crane truck is mounted on eight sprung wheels, four of which are carried in a swivelling bogie. Other details include brakes on the travelling wheels and outriggers.

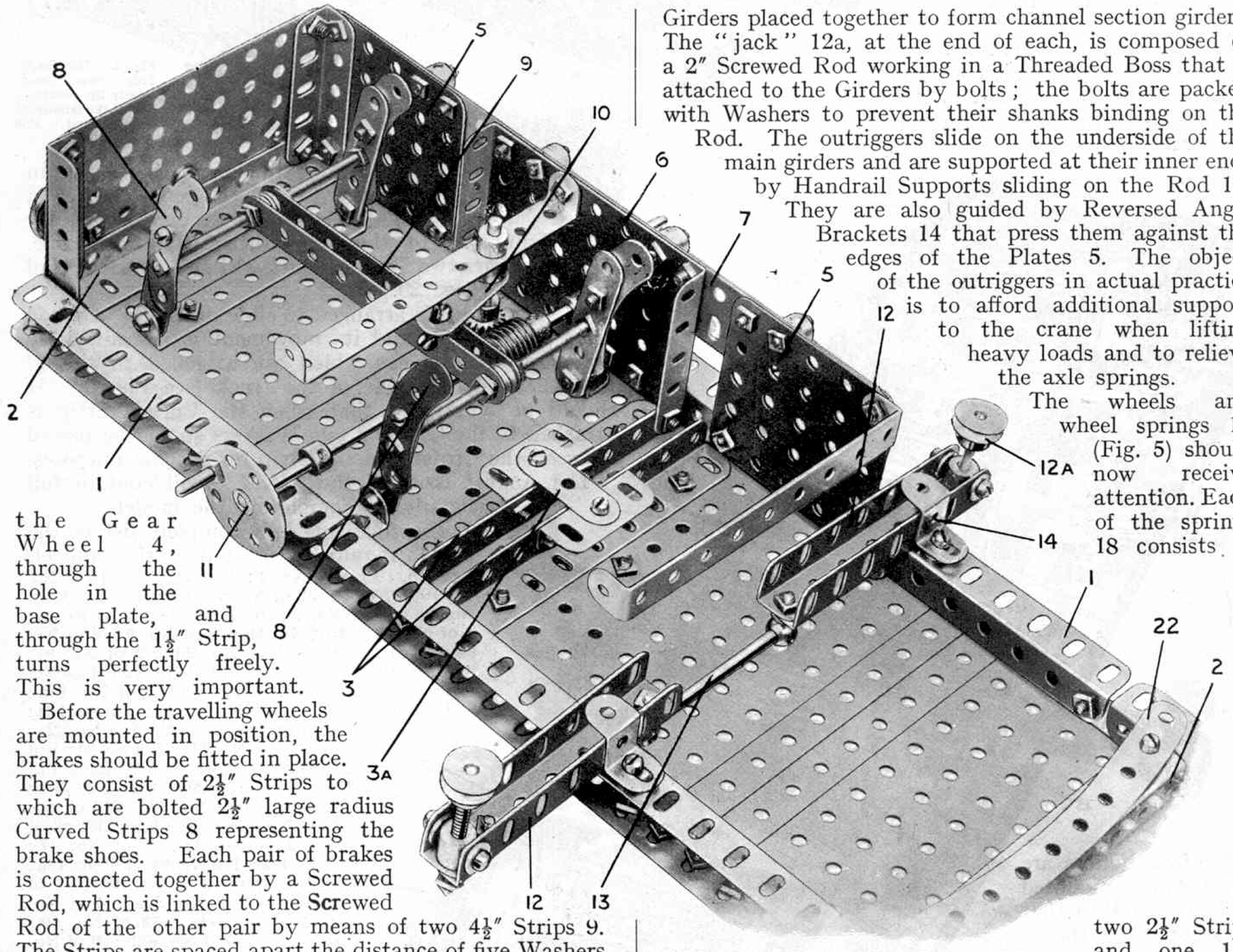


Fig. 3. Underneath view of Crane Truck, with one side and wheel mechanism removed to show the Brake rigging and Outriggers.

the Gear Wheel 4, through the hole in the base plate, and through the 1½" Strip, turns perfectly freely. This is very important.

Before the travelling wheels are mounted in position, the brakes should be fitted in place. They consist of 2½" Strips to which are bolted 2½" large radius Curved Strips 8 representing the brake shoes. Each pair of brakes is connected together by a Screwed Rod, which is linked to the Screwed Rod of the other pair by means of two 4½" Strips 9. The Strips are spaced apart the distance of five Washers and retained in position on the Rods by lock-nuts. A Crank 10 is secured on a short Rod journalled in a hole of the base plate and also in a 4½" Double Angle Strip as shown in Figs. 3 and 5. The Rod carries a ½" Pinion that is arranged to mesh with a Worm on a 6½" Rod on which the hand wheels 11 are secured. The Crank is attached pivotally to the links 9 by means of a bolt inserted in the set-screw hole of a Collar, which is held in place between the links by a ½" Bolt. By turning the handwheels 11, the Crank swings slowly and presses the brake shoes on to the wheels.

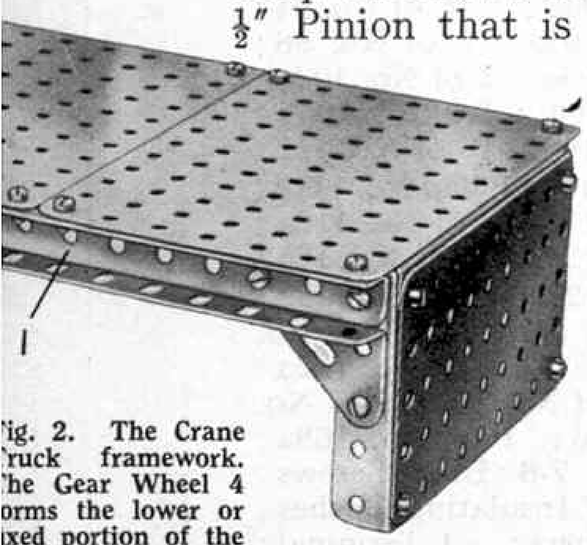


Fig. 2. The Crane Truck framework. The Gear Wheel 4 forms the lower or fixed portion of the Ball Bearing unit.

Each of the "outriggers" 12 (Fig. 3) consists of two 3½" Angle Girders placed together to form channel section girders. The "jack" 12a, at the end of each, is composed of a 2" Screwed Rod working in a Threaded Boss that is attached to the Girders by bolts; the bolts are packed with Washers to prevent their shanks binding on the Rod. The outriggers slide on the underside of the main girders and are supported at their inner ends by Handrail Supports sliding on the Rod 13. They are also guided by Reversed Angle Brackets 14 that press them against the edges of the Plates 5. The object of the outriggers in actual practice is to afford additional support to the crane when lifting heavy loads and to relieve the axle springs.

The wheels and wheel springs 18 (Fig. 5) should now receive attention. Each of the springs 18 consists of two 2½" Strips and one 1½" Strip. A Bolt with a Washer on its shank is passed through the centre hole of all three Strips and inserted in a Collar. The "spring hangers" 19 are ¾" Bolts inserted in Collars that are attached pivotally to the frame by ½" lock-nutted Bolts. Fig. 4 shows the springs very clearly. The wheels themselves consist of Face Plates bolted to Wheel Flanges; eight in all are required.

The driving axle 15a (Fig. 5) has secured to it a 1½" Contrate that meshes with a ½" Pinion 17 on the Rod that forms the central pivot about which the crane turns and which also transmits the drive from the gear box. The end of this Rod is journalled in the bore of a Coupling mounted loosely on the Rod 15a. Couplings 16 are employed in the place of Collars to prevent end play in the Rods 15 and 15a; if Collars

were employed here their grub screws would foul the flanges of the Plates 6.

The two axles 15, 15a are connected together by means of a length of Sprocket Chain passing over 2″ Sprocket Wheels secured to the axles. This arrangement ensures that the drive is distributed over all four wheels, thus obviating the possibility of wheel slip.

It will be noticed that the ends of the axles 15 and 15a are passed through the slotted holes of the Flat Girders 7 and are journalled in the Collars secured to the springs. The slots thus form guides which, while permitting the free vertical movement of the axles under the action of the springs, prevent any adverse side strain being applied to the springs.

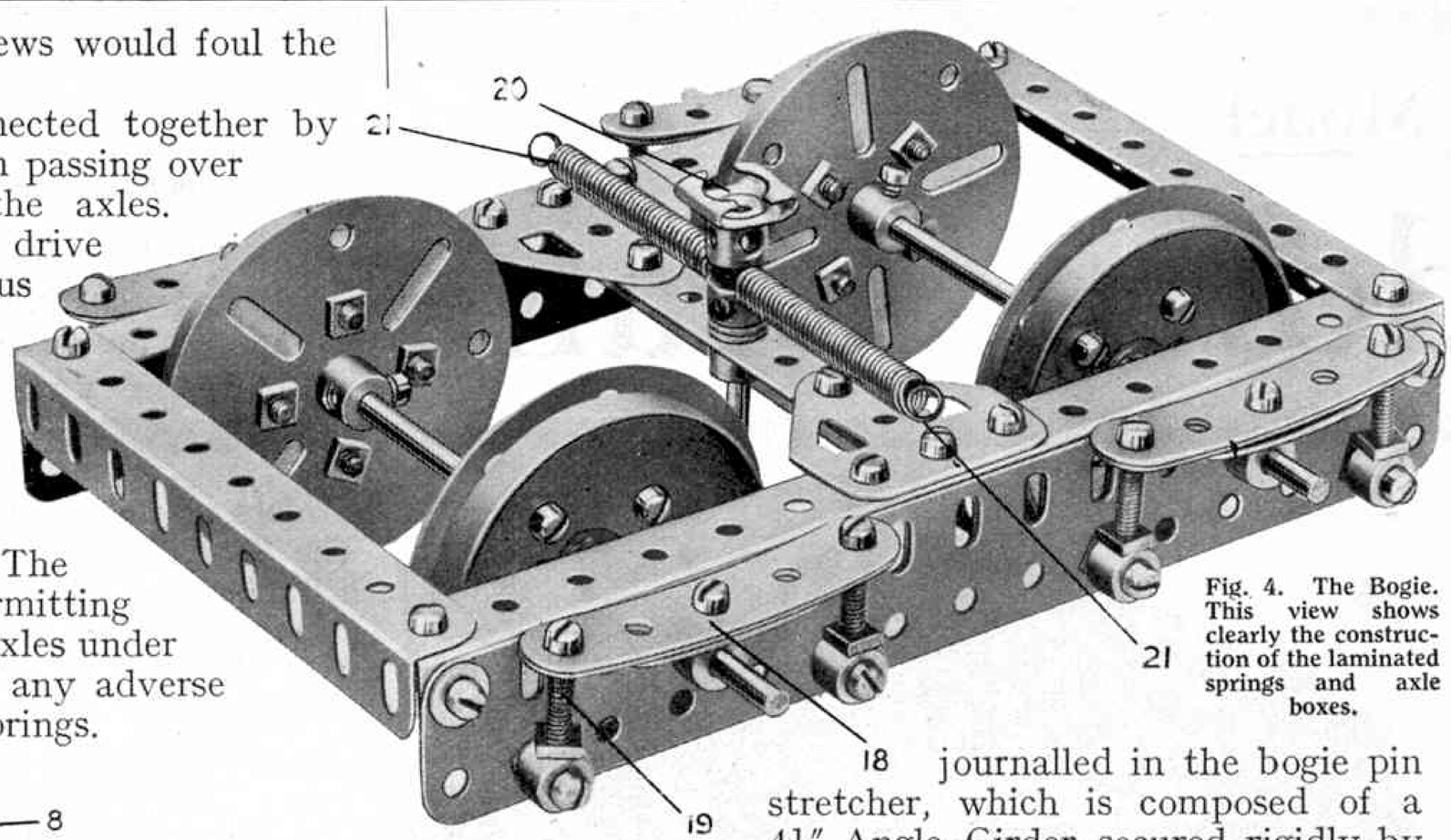
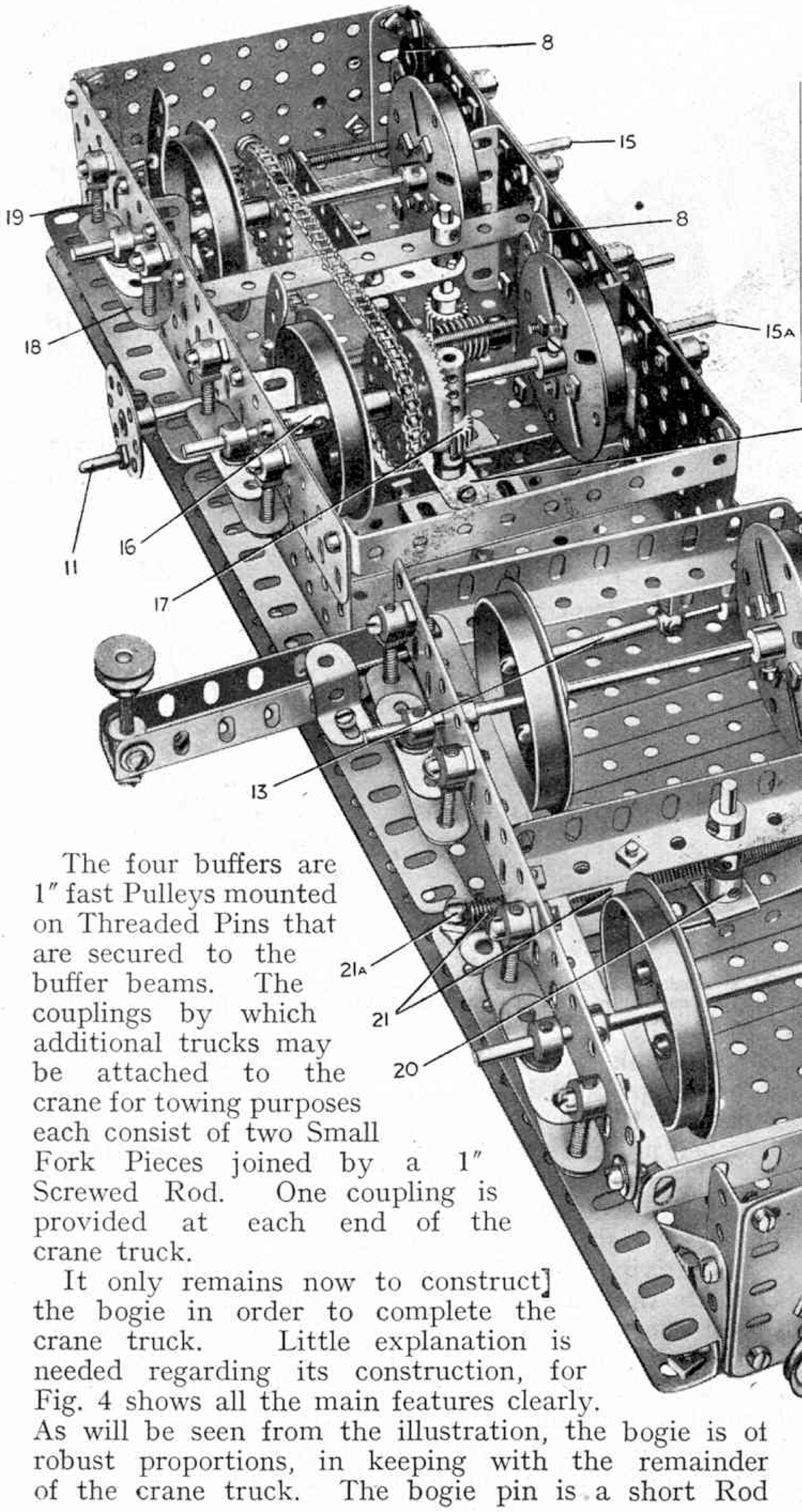


Fig. 4. The Bogie. This view shows clearly the construction of the laminated springs and axle boxes.



The four buffers are 1″ fast Pulleys mounted on Threaded Pins that are secured to the buffer beams. The couplings by which additional trucks may be attached to the crane for towing purposes each consist of two Small Fork Pieces joined by a 1″ Screwed Rod. One coupling is provided at each end of the crane truck.

It only remains now to construct the bogie in order to complete the crane truck. Little explanation is needed regarding its construction, for Fig. 4 shows all the main features clearly. As will be seen from the illustration, the bogie is of robust proportions, in keeping with the remainder of the crane truck. The bogie pin is a short Rod journalled in the bogie pin stretcher, which is composed of a $4\frac{1}{2}$″ Angle Girder secured rigidly by Flat Trunnions to the side Girders of the frame. The pin carries two Tension Springs 21 and is surmounted by an Eye Piece 20.

The Eye Piece is arranged to slide on the $5\frac{1}{2}$″ Curved Strip 22 (Fig. 5), and its movement is restrained by means of the Springs which are attached to the $\frac{3}{8}$″ Bolts 21a on each side of the truck (see Fig. 5). It should be mentioned that when the Curved Strip is attached to the Girder 2 two Washers should be placed between the Girder and the Strip for spacing purposes.

The August issue of the *"M.M."* will contain full details for completing the model.

The following is a complete list of the parts required to build the model. 2 of No. 1b; 8 of No. 2; 6 of No. 2a; 12 of No. 3; 10 of No. 4; 32 of No. 5; 15 of No. 6; 11 of No. 6a; 2 of No. 7; 6 of No. 7a; 2 of No. 8; 2 of No. 8a; 4 of No. 8b; 8 of No. 9; 8 of No. 9a; 6 of No. 9b; 4 of No. 9d; 2 of No. 9f; 8 of No. 10; 6 of No. 11; 10 of No. 12; 1 of No. 12b; 5 of No. 14; 1 of No. 15; 5 of No. 15a; 7 of No. 16; 3 of No. 16a; 3 of No. 17; 2 of No. 18a; 2 of No. 20b; 10 of No. 22; 5 of No. 22a; 3 of No. 23; 2 of No. 23a; 5 of No. 24; 9 of No. 26; 6 of No. 27a; 1 of No. 27b; 1 of No. 28; 1 of No. 29; 1 of No. 30a; 1 of No. 30c; 1 of No. 32; 342 of No. 37; 62 of No. 37a; 82 of No. 38; 2 of No. 43; 2 of No. 45; 1 of No. 47; 1 of No. 47a; 1 of No. 48; 1 of No. 48a; 3 of No. 48b; 2 of No. 48c; 1 of No. 50a; 11 of No. 52a; 4 of No. 53; 2 of No. 53a; 63 of No. 59; 1 of No. 62; 6 of No. 62b; 9 of No. 63; 2 of No. 64; 4 of No. 70; 4 of No. 72; 2 of No. 76; 2 of No. 77; 2 of No. 80a; 2 of No. 81; 2 of No. 82; 3 of No. 89; 6 of No. 90; 2 of No. 90a; 2 ft. of No. 94; 2 of No. 95a; 2 of No. 96; 2 of No. 96a; 2 of No. 103a; 2 of No. 103f; 2 of No. 103k; 8 of No. 109; 18 of No. 111; 24 of No. 111a; 6 of No. 111c; 9 of No. 115; 4 of No. 116a; 1 of No. 120a; 2 of No. 125; 4 of No. 126a; 2 of No. 133; 4 of No. 136; 8 of No. 137; 2 of No. 147b; 1 of No. 152; 1 of No. 162a; 1 of No. 162b; 2 of No. 163; 1 of No. 164; 1 of No. 166; 1 of No. 168a; 1 of No. 168b; 7-6 B.A. Screws; 14-6 B.A. Nuts; 7 Insulating Bushes; 7 Insulating Washers; 1 Terminal; 1 Electric Motor.

Fig. 5. Underneath view of Crane Truck.

Special Summer "Realism" Competition

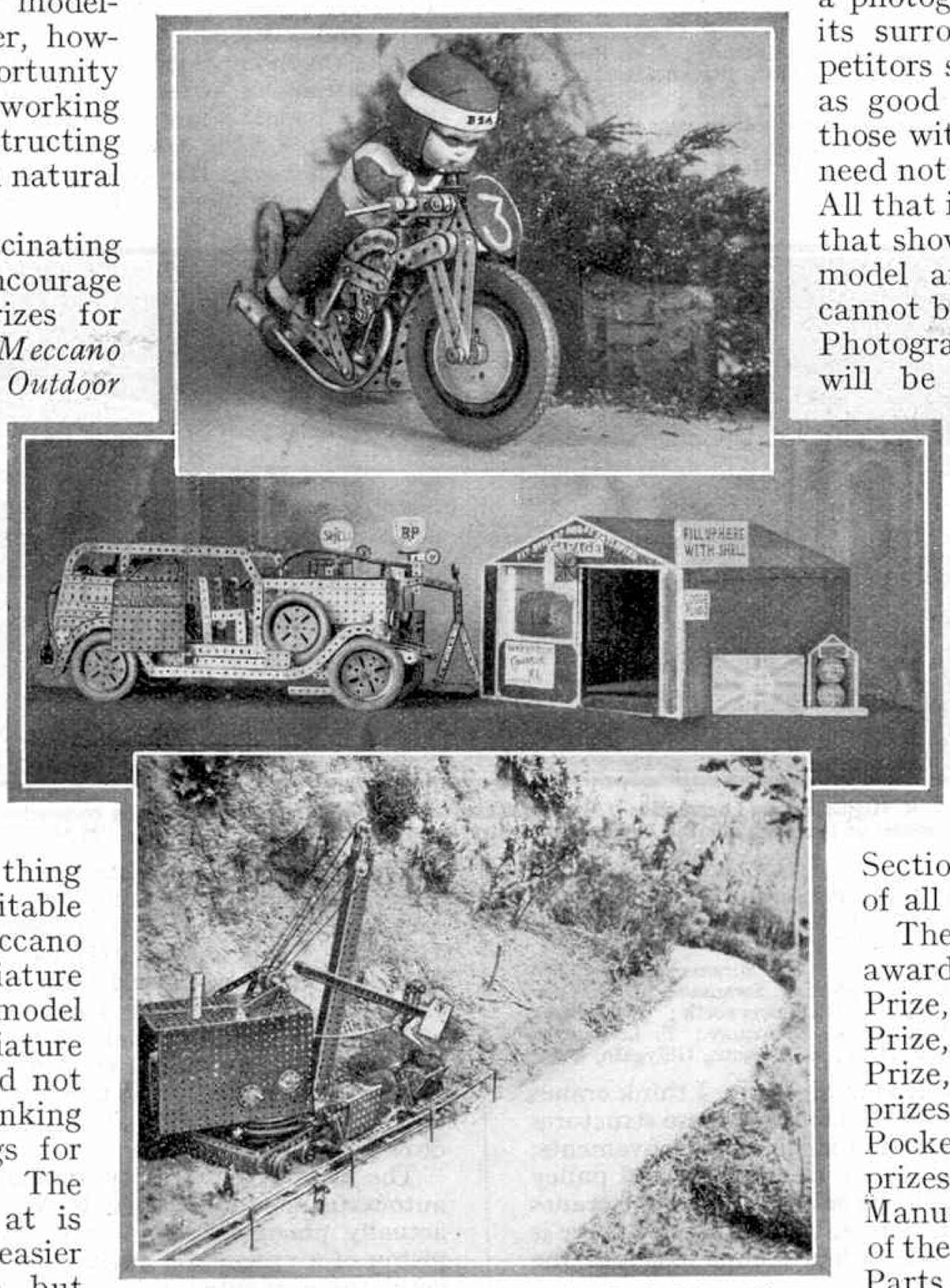
Outdoor Meccano Model-Building

Prizes for Models Set in Realistic Surroundings

DURING the summer months Meccano boys rightly spend as much time as possible out in the open air, revelling in games and sports of all kinds, and in long walks and cycle rides. During this period Meccano model-building naturally passes a little into the background. The majority of enthusiastic Meccano boys do not abandon their model-building activities altogether, however, but take the opportunity afforded by the fine days of working out-of-doors and constructing models that can be placed in natural and realistic surroundings.

This is a particularly fascinating pastime, and in order to encourage it we offer this month prizes for the best examples of "*Meccano Models Set in Realistic Outdoor Surroundings.*" Models need not be specially designed or built for this Contest. Any model that is available may be entered, provided that it has not already won a prize in a Meccano competition, and that it is incorporated in a suitable outdoor setting.

The photographs reproduced on this page provide examples of the kind of thing that is required. Other suitable subjects would be a Meccano bridge erected over a miniature river or ravine, or a model locomotive at work in a miniature siding. Competitors should not make the mistake of thinking that elaborate surroundings for their models are necessary. The main result to be aimed at is realism, and this is often easier to secure with a simple but boldly arranged setting than with an elaborate setting crammed with as much detail as possible. In other words, it is the effect of the setting as a whole that counts, not the nature of the details of which it is made up.



The wonderfully realistic effects that can be obtained by setting a model amidst suitable scenery are well shown by these photographs, each of which won a prize in a Meccano "Realism" Competition.

It is realised that for large numbers of Overseas readers climatic conditions are exactly opposite to those existing in this country. In order to secure as far as possible equality for all readers, we have decided that Overseas competitors may regard this contest as being for the best examples of Meccano models in realistic surroundings of any kind, either indoor or outdoor. This special condition which, it is important to note, applies to Overseas competitors only, allows models to be placed in suitable artificial settings indoors.

How to Enter the Contest

In order to enter this Contest it is necessary to send a photograph showing the model in its surroundings. While all competitors should endeavour to obtain as good a photograph as possible, those with small and cheap cameras need not be in the least discouraged. All that is necessary is a photograph that shows clearly the nature of the model and its setting. Drawings cannot be accepted for this Contest. Photographs of unsuccessful entries will be returned to the senders provided that a stamped addressed envelope of the necessary size is enclosed with the entry. It should be noted, however, that photographs of prize-winning entries become the property of Meccano Limited.

Entries will be divided into two sections—Section A, for readers of all ages living in the British Isles; Section B, for Overseas readers of all ages.

The following prizes will be awarded in each Section:—First Prize, cheque for £3-3s.; Second Prize, cheque for £2-2s.; Third Prize, cheque for £1-1s.; six prizes of solid leather inscribed Pocket Wallets value 10/6; six prizes of complete Instruction Manuals; twelve prizes of a copy of the book "How to Use Meccano Parts." In addition a number of Meccano Engineer's Pocket Books will be awarded in each Section.

The competitor's name, address and age must be written on the back of each photograph sent in, together with the name of the Contest—Summer "Realism" Contest—and the letter A or B, indicating the Section for which the entry is eligible.

Envelopes should be addressed:—Summer "Realism" Contest, Meccano Limited, Old Swan, Liverpool.

Entries for Section A must be posted so as to reach Headquarters on or before 31st August; and those for Section B on or before 30th November, 1931.

Results of Meccano Model-Building Contests

By Frank Hornby

No. 00 and No. 4 "Outfits" Contest (Home Sections)

IN entering this Contest, competitors were allowed free rein in their choice of subject, the only condition being that in building models no parts were to be used other than those contained in either a No. 00 or a No. 4 Outfit.

The prize-winners in the Home Sections are as follows :—

Section A (for No. 00 Outfit models).

FIRST PRIZE, Meccano goods value £2-2s. : K. Gibbes, Weedon, Northants. SECOND PRIZE, Meccano goods value £1-1s. : J. Lewis, Edinburgh. THIRD PRIZE, Meccano goods value 10/6 : E. Strang, Beeston, Nottingham.

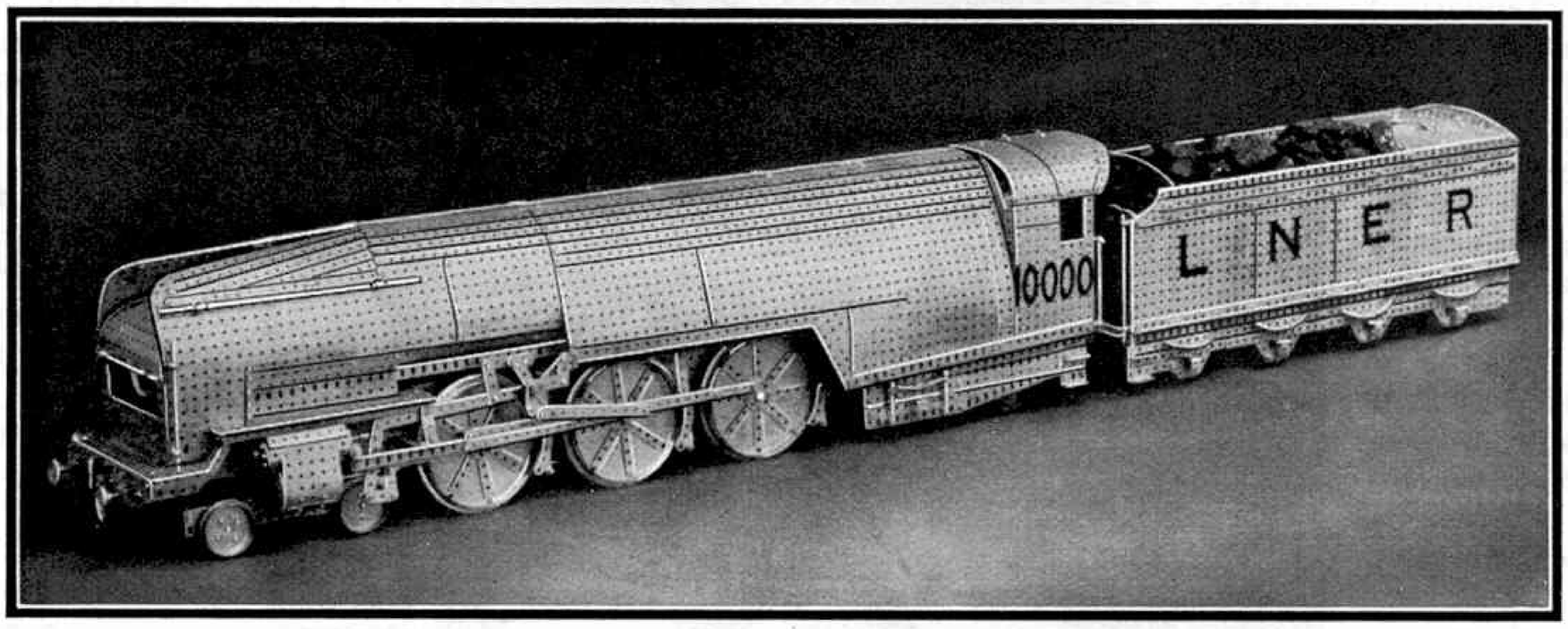
SIX PRIZES, Meccano parts to convert a No. 00 to a No. 1 Outfit : R. Clark, Clevedon, Somerset ; A. Rousell, Rugby ; R. Mills, Nailsworth, near Stroud ; J. W. Rowann, Belfast ; K. Smallpiece, Wisley, near Ripley ; R. Chase, Blackheath, London, S.E.3.

SIX PRIZES of Meccano No. 00a Outfits : E. V. Clayton, Broadbottom, near Manchester ; S. Ettinger, Meadows, Notts. ; R. Lindsey, Harringay, London, N.4 ; S. W. Chance, London, N.19 ; W. E. Rudd, Dublin ; T. W. Hunt, Birmingham.

Section B (for No. 4 Outfit models).

FIRST PRIZE, cheque for £3-3s. : L. Hollyoak, Earlsdon, Coventry. SECOND PRIZE, cheque for £2-2s. : C. Marston, Halifax. THIRD PRIZE, cheque for £1-1s. : J. Baker, Clifton, Bristol.

SIX PRIZES, Meccano goods value 10/6 : K. Bishop, Worcester Park, Surrey ; A. Adamson, Leyburn, Yorks. ; J. F. Anderson, Glasgow ; W. C. Rainsford, Folkestone ; W. A. Bradshaw, Sheffield ; J. A. Saunt, Stoke, Coventry.



This model of the L.N.E.R. High-pressure Locomotive "No. 10000," by R. O. Jukes, forms an interesting comparison with R. S. Miller's model of the same subject, which was illustrated on page 312 of the April 1931 "M.M."

SIX PRIZES, Meccano goods value 5/– : P. Elvin, Portsmouth ; F. G. Dallaway, Bexhill-on-Sea, Sussex ; P. J. Daniel, Dublin ; L. Libaert, Cheam, Surrey ; D. Crowley, Birmingham ; C. H. Crocker, Teignmouth.

TWELVE PRIZES of Meccano Engineer's Pocket Books : G. Mirams, Moseley, Birmingham ; G. M. Tompkins, Kettering ; G. Ackland, Swansea ; J. S. Gow, Dundee ; R. Roylance, Dagenham ; C. Pearce, Rickmansworth ; J. Webster, Clacton-on-Sea ; I. Davies, Harrow ; P. H. Drake, Newquay ; F. L. Sawyer, Burwash ; H. Webb, Wood Green, London, N.22 ; C. Parsons, Gillygate, York.

Of the subjects most often reproduced in Meccano, I think cranes head the list. This is due, no doubt, to the fact that these structures incorporate many of the more interesting mechanical movements, such as sliding gear shafts, clutches, brake mechanism, and pulley block apparatus. This in itself would be sufficient to make cranes a popular subject for Meccano constructors, but in addition there is the fascination of working the model when completed, and the carrying out of load-lifting tests, etc.

It is therefore not surprising to find a crane heading the prize list in the Section for No. 4 Outfit models. It was built by L. Hollyoak, and is a reproduction of one of the travelling steam cranes used on the L.M.S. railway for laying pipes. The superstructure that carries the engine and jib swivels on a stout bearing composed of two Wheels mounted face to face, the upper Wheel being bolted to the superstructure and the lower Wheel to the chassis. A Meccano Boiler, bolted at the rear of the cab, gives a touch of realism to the model. Unfortunately, the photograph submitted is not clear enough for satisfactory reproduction.

Second Prize has been won with a model facing and surface-milling machine, constructed by C. Marston. Without the aid of an illustration it is difficult to convey any adequate impression of this entry. It is really an excellent model, and judging from the remarkably clear and precise working drawings Marston submitted, it is evident that he thoroughly understands the principles of these wonderful machine tools. The model is a good example of the suitability of Meccano parts for the reproduction of machine tools generally.

Wire rope-making appears to have a decided attraction for Meccano model-builders, for hundreds of models of wire-stranding machines have been sent in from time to time. This Contest produced yet another good example of this kind, which gained Third Prize for J. Baker. The model represents a machine of the usual type, and is driven by a Meccano Clockwork Motor, suitably geared to the revolving head that carries the bobbins of wire. Several illustrations of wire-stranding machines have appeared in the *"M.M.,"* and a very efficient little model is described under Model No. 4.57 in the No. 4-7 Instructions Manual.

At times even the keenest Meccano enthusiasts find it hard to produce a new model. This shortage of ideas occurs to all model-builders occasionally, and at such times a walk in the country, or perhaps a train journey, will seldom fail to provide one or two interesting subjects to model.

W. Rainsford found himself in this state when he decided to take part in this Contest. Instead of setting to work immediately and building the first commonplace model that occurred to him, however, he took a walk to Folkestone, and as luck would have it, a Swedish timber ship was lying in the Harbour. This immediately gave him an idea, and on his return home he set to work and built the interesting model with which he succeeded in winning a prize in this Contest.

The length of the model is 3 ft. 3 in. ; width 3½ in. ; and height to the tip of the mast 1 ft. 2 in. The decks carry six cranes for handling the timber, and there are davits for life-boats, a wireless cabin, and a boat deck. The mast is equipped with the customary crow's nest.

The most original entry among the smaller prize-winners is an automatic pneumatic sieve, by W. A. Bradshaw. The model is not actually pneumatically worked, of course, but the cylinder and piston of a pneumatic engine are represented. The piston, which oscillates a pivoted riddle backward and forward, is really an Eccentric, mounted on a Rod suitably journalled and provided with a handwheel. The arm of the Eccentric is connected to the riddle, and by turning the handwheel the motion of the Eccentric jerks the riddle backward and forward on its pivot rod, so shuffling and sifting its contents. The riddle is made in circular form from Strips bent to shape, and is filled in with netting made up from pieces of wire interlaced at right-angles to each other. The riddle and pneumatic engine are supported on a tri-legged stand, constructed from Angle Girders.

First Prize for models built from No. 00 Outfits was won by K. Gibbes, for a model concrete mixer, of the petrol-driven portable type. The engine housing is built up from Flat Trunnions, and a 2½" × ½" Double Angle Strip ; the Trunnions being bolted to a 5½" × 2½" Flanged Plate. The barrel is formed from 2½" Strips secured by Angle Brackets to a Bush

(*Continued on page 608*)

"Christmas" Contest (Overseas Section)

The best model in the Overseas Section of the "Christmas" Contest is undoubtedly that sent in by R. O. Jukes, several of whose fine models have been illustrated in past issues of the "*M.M.*" In choosing the Second and Third Prize-winners, however, considerable difficulty was experienced, owing to the fact that several models appeared of equal merit. Therefore, in order to deal with the matter in as fair a manner as possible, it was decided to divide the Second Prize between two competitors, and to deal similarly with the Third Prize. I may say that it is a long time since I have seen so many fine models collected together in one contest, and I can assure readers that it is impossible to do them full justice merely by a few words of description.

The following is the complete list of prize-winners:—

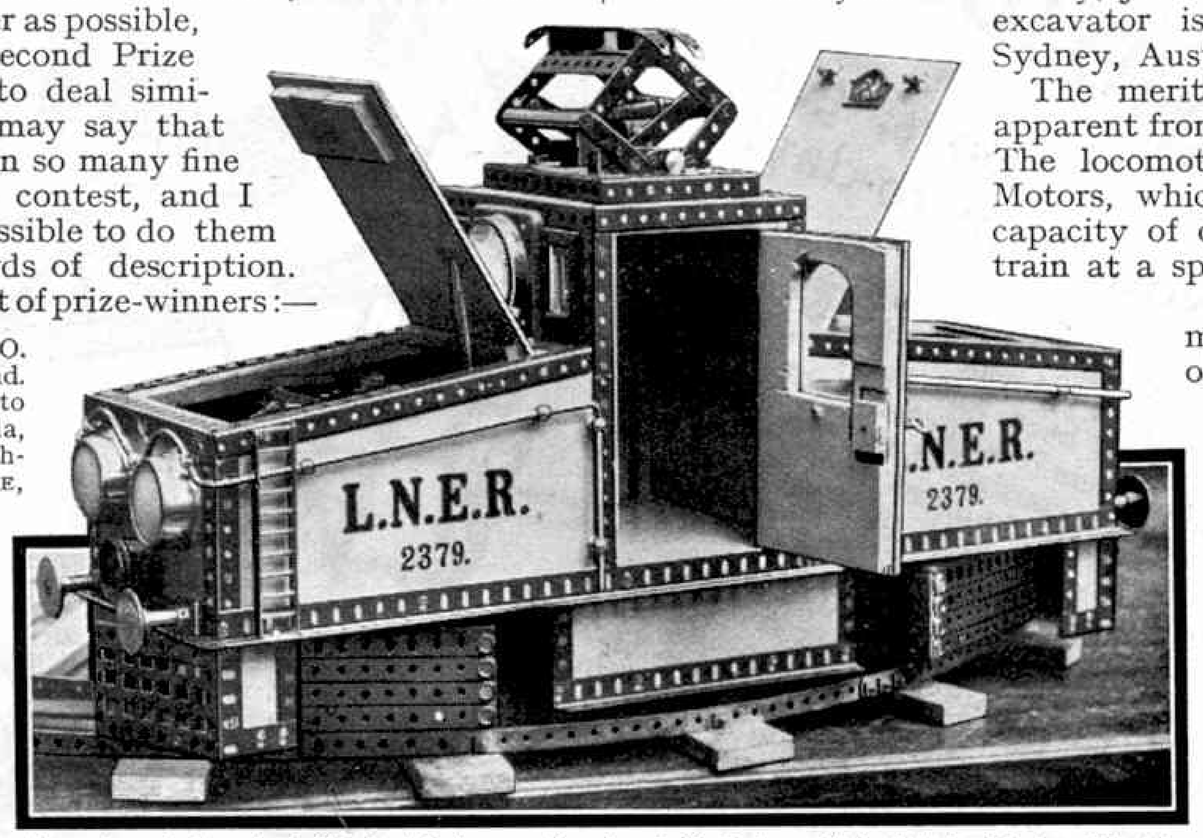
FIRST PRIZE, cheque value £3-3s.: R. O. Jukes, Christchurch, New Zealand. SECOND PRIZE, Tie, each competitor to receive cheque for £1-1s.: J. R. Lala, Bombay, India; C. J. McCain, Leichhardt, Sydney, Australia. THIRD PRIZE, Tie, each competitor to receive cheque for 10/6: W. R. v. d. Broek, Utrecht, Holland; John Rue, Lithgow, N.S.W., Australia.

SIX PRIZES, of Meccano goods value 10/6: N. E. Hodson, Wellington, New Zealand; G. Tidy, Toronto, Canada; J. Ringnalda, Leeuwarden, Holland; J. G. Horn, Winnipeg, Canada; P. v. d. Burgh, Dubbeldam, Holland; G. R. Nisbet, Mont Albert, Melbourne, Australia.

TWELVE PRIZES of Meccano goods value 5/-: F. Pantanella, Rome, Italy; J. J. v. d. Ploeg, Hengelo, Holland; J. A. Rodriguez, Montreal, Canada; W. L. Barry, Christchurch, New Zealand; N. Parton, Elizabeth Bay, Sydney, Australia; D. R. Heeramaneck, New Gamdevi, Bombay, India; M. Rankin, Toorak, Melbourne, Australia; A. F. Russell, Bulawayo, Rhodesia; V. L. Noguera, Buenos Aires, Argentine; J. Hers, Potchefstroom, S. Africa; L. Cjhyssaert, Courtrai, Belgium; R. Olafsen, Oslo, Norway.

TWELVE PRIZES of Meccano Engineer's Pocket Books: J. Foley, King William's Town, C.P., S. Africa; F. D. Aria, Bombay, India; W. Welsh, Ottawa, Canada; C. W. Sharpe, Nelson, New Zealand; G. Hugel, Mulhouse, France; P. B. Molloy, Hobart, Tasmania, Australia; C. D. Pengelly, Walderston, Jamaica, B.W.I.; S. Mashug Alley, Calcutta, India; D. Miller, East St. Kilda, Melbourne, Australia; F. Wolff, Yeronga, Brisbane, Australia; K. Cameron, Mayfair, Transvaal, S. Africa; F. R. Peters, Cowandilla, S. Australia.

SPECIALLY COMMENDED (Certificates of Merit): A. Browning, Miling, W. Australia; P. Arallande, Huttivil, Switzerland; M. A. Thomas, Udamalpet, S. India; A. R. Riddell, Toronto, Canada; A. Haw, Dordrecht, C.P., S. Africa; K. Singh, Lahore, India; D. Cahill, Montevideo, Uruguay, S. America; M. Conti, Milan, Italy; R. Benater, Johannesburg, S. Africa; A. Masterton, Cambridge, S. Africa; N. Paola, Durban, Natal, S. Africa; W. J. Abery, Durban, Natal, S. Africa; K. J. Orams, Blenheim, New Zealand; B. Butchers, Petone, New Zealand.



A neat and cleverly-built electric locomotive, by J. R. Lala. It is fitted with two Electric Motors, and can pull a load of 110 lb. at a speed of 10 m.p.h.

To describe all the prize-winning models in this Section would demand a great deal more space than I am able to spare; and therefore I propose this month to deal with the first three prize-winning entries only, and to hold over the remaining models for a second article that I hope to include as soon as possible in the "*M.M.*"

Readers will perhaps remember that the First Prize in the Home Section of this Contest, the results of which appeared in the April issue, was awarded to R. S. Miller, of Newark, for a remarkably well-built model of the L.N.E.R. locomotive "No. 10000." It is a strange coincidence, therefore, to find another model of the same subject carrying off the chief award in the Overseas Section. The builder of this latest model is R. O. Jukes, of Christchurch, New Zealand. It is illustrated here, and readers will be able to decide for themselves which is the better model of the two. There are numberless good points about each of them, but I think Juke's model is neater in appearance, although it lacks some of the detail present in Miller's model. The model is fitted with an Electric Motor, and this is started, stopped or reversed by means of a lever in the cab; gearing transmits the Motor drive to the main wheels of the engine. The valve gear also is controlled from the cab. The tender is of the corridor type, that is, it has a passage down one side, which in the actual tender permits a change of crew while the train is in motion. The passage is closed at the rear end with a sliding door, and at the front by a folding door. In the cab are to be seen pressure and water gauges, seats for the driver and fireman, and a hinged firebox door.

Readers will be interested to know that Juke's model was on view at the Golden Arrow and British Industries Exhibition, in New Zealand, which was patronised by over 25,000 people.

The two models that tied for Second Prize are an electric locomotive, and a mechanical bucket excavator. The first-mentioned was built by an Indian boy, J. R. Lala, of Bombay, and the model excavator is the work of C. J. McCain, Sydney, Australia.

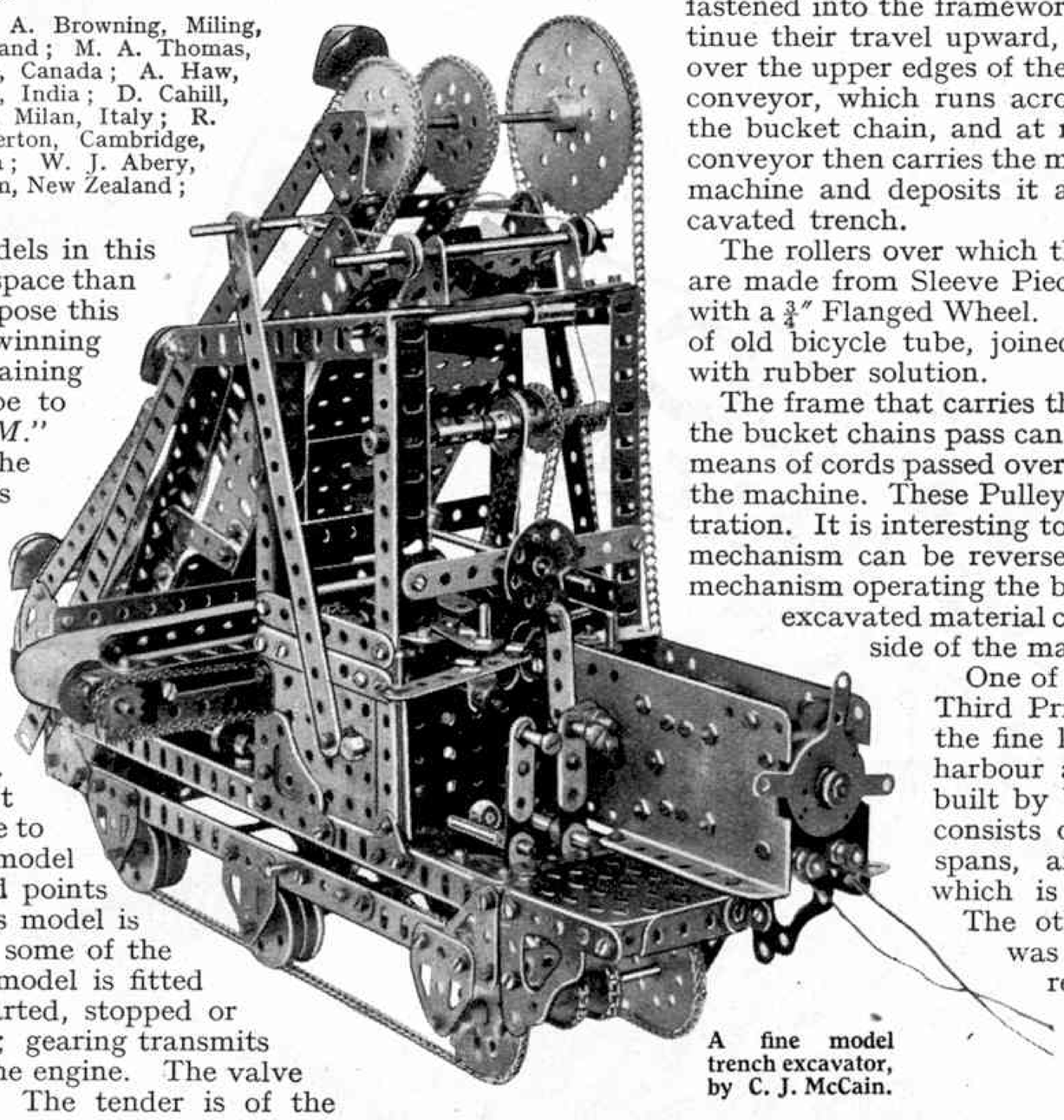
The merit of these fine models will be apparent from the accompanying illustrations. The locomotive is fitted with two Electric Motors, which together have a load-pulling capacity of over 110 lb. and can propel the train at a speed of 10 m.p.h.

The interior of the model is a most interesting place, for it is full of practical detail work. For example, there is a main terminal board, to which all wires are conveyed. As the model is fitted with headlights, searchlight and buzzers, as well as the two Motors, it will be realised that there is quite a maze of wiring, which is considerably simplified, however, by means of the central terminal board. Also inside the model is a variable resistance controller for regulating the speed of the engine, and a transformer for reducing the rail current to a voltage suitable for lighting the small headlights. The locomotive runs on two rails, between which is placed a separate set of metals for carrying the electric current. If desired the locomotive may be run on current picked up by means of a collapsible pantagraph collector in contact with overhead conductors.

C. J. McCain's model excavator possesses many interesting features, not the least of which is the method of discharging the excavated material. As the chains move along, the buckets dig into the earth and drag the material up against two Flat Plates, fastened into the framework. As the buckets continue their travel upward, they tip their contents over the upper edges of the Plates and on to a belt conveyor, which runs across the machine behind the bucket chain, and at right angles to it. The conveyor then carries the material to the side of the machine and deposits it at the verge of the excavated trench.

The rollers over which the conveyor belt moves are made from Sleeve Pieces, capped at each end with a ¾" Flanged Wheel. The belt itself is a piece of old bicycle tube, joined into an endless band with rubber solution.

The frame that carries the Sprockets over which the bucket chains pass can be raised or lowered by means of cords passed over ½" Pulleys at the top of the machine. These Pulleys are shown in the illustration. It is interesting to note that the conveyor mechanism can be reversed independently of the mechanism operating the bucket chain, so that the excavated material can be deposited at either side of the machine at will.



A fine model trench excavator, by C. J. McCain.

One of the models that tied for Third Prize is a reproduction of the fine lifting bridge across the harbour at Rotterdam. It was built by W. van der Broek, and consists of two stationary shore spans, and a central portion, which is the liftbridge proper. The other Third Prize model was built by J. Rue, and represents a machine used for charging ingots into reheating furnaces, preparatory to rolling into sheets. The mass of unwrought metal is gripped between a pair of powerful tongs secured on the end of a jib-like pivoted boom, which is carried on a swivelling superstructure supported by a travelling base. This base moves on rails on the top of a chassis, which in turn runs on a track at right-angles to the upper rails.

PRICE 9d 40 PAGES

THE BEST OF THE YEAR'S NEW MODELS AND IDEAS

Boys, get your copy to-day!

The 1931 edition of the Book of New Models is proving the most popular edition ever published. Nearly 20,000 copies have already been sold to enthusiastic Meccano model-builders, and orders continue to pour in. The new book consists of no less than 40 pages of new models, new mechanisms and new ideas, as compared with only 24 pages in all previous editions. Every Meccano boy should obtain a copy as early as possible.

The principal object of this book is to keep Meccano model-builders in touch with the latest improvements and developments connected with their hobby. The book contains illustrations and details of the best of the new models and many others that have been designed by our own experts. The movements submitted in recent competitions, together with models shown in this book are of outstanding interest and variety. They range from simple models that can be built with small Outfits to elaborate types that will appeal to older boys.

HOW TO OBTAIN THE BOOK

The 1931 Book of New Models may be obtained from any Meccano dealer, price 9d., or direct from Meccano Ltd., Old Swan, Liverpool, price 10½d. post free. There are special editions for Australia, New Zealand, South Africa and Canada and details of the prices of the book in these countries are as follows:—

Australia: Price 1/9 from dealers or 1/11 from E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832K).

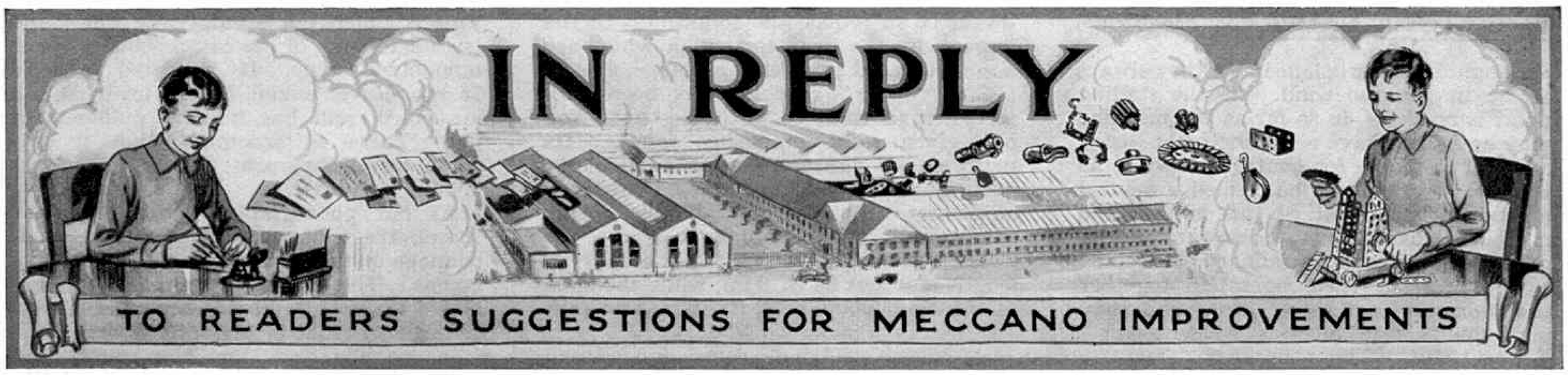
New Zealand: Price 1/– from dealers or 1/2 from Models Ltd., P.O. Box 129, Auckland (Kingston Street).

South Africa: Price 1/– from dealers or 1/2 from Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).

Canada: Price 25 cents from dealers or 30 cents from Meccano Ltd., 34, St. Patrick Street, Toronto.

Readers living in countries other than those mentioned above should order from Meccano Ltd., Old Swan, Liverpool, England, sending a remittance of 1/2 with their orders.

Get your copy to-day!



In this page we reply to suggestions for new and improved Meccano parts that are submitted by readers. We receive many hundreds of these suggestions, and in order to provide additional interest for contributors we are offering a prize of 10/– for the best idea sent in during each month. Any number of ideas may be submitted by each reader, but each suggestion must be written on a separate sheet of paper, and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

CLOCKWORK MOTOR GEAR BOX.—A two-speed gear incorporated in the clockwork motor would no doubt be useful, but it would add considerably to the cost of the motor. A gear-box suitable for all ordinary purposes may easily be built up from Meccano Gears and Pinions. (*Reply to F. Ashworth, Oldham, and P. Cardew, Paris*).

DOUBLE WHEELS FOR LORRIES.—Special double wheels to form the rear wheels of model motor lorries, tractors, etc., are not necessary. Two Pulleys mounted together and fitted with miniature Dunlop Tyres will be found quite suitable for this purpose. For certain types of models two 2" Dunlops may be fitted together on a Boiler End. (*Reply to B. C. Boyle, Guildford, Co. Down, and P. M. Woodward, Truro*).

STRIPS FOR USE AS SLEEPERS.—Your proposed new 1¼" strips for use as sleepers in built-up gauge 0 track would be an unnecessary addition to the Meccano System. Track of this gauge can be built up by securing Angle Girders by their elongated holes, with their flanges outward, to 2½" Strips. Further, strips 1¼" in length would not be standard with other Meccano parts and would have very limited uses. (*Reply to R. Chapman, Ascot*).

CHANNEL SECTION GIRDERS.—It is well known that channel section girders possess greater strength than angle girders, and uses for such girders frequently occur in constructional work. Two Angle Girders bolted together may be used for this purpose. The broad flange of one girder should be bolted to the narrow flange of the other so that the centres of the holes in the remaining flanges are exactly opposite. Other forms of built-up girders are dealt with in the "*How to Use Meccano Parts*" book. We realise, however, that specially-manufactured channel girders would be neater than built-up girders and we are therefore keeping your idea in mind. (*Reply to L. Gurr, Maidstone*).

AERO ENGINE UNITS.—We cannot consider your suggestion that we should manufacture special aero engine units. Aeroplanes are very popular subjects with Meccano model-builders, and the many examples that we have seen show that no difficulty is experienced in reproducing realistic reproductions of aero engines. Worms or Pulley Wheels can generally be used to represent cylinders, and may be mounted round the peripheries of Bush Wheels or Face Plates by means of Angle Brackets. (*Reply to Ernest Mace, Talgarth*).

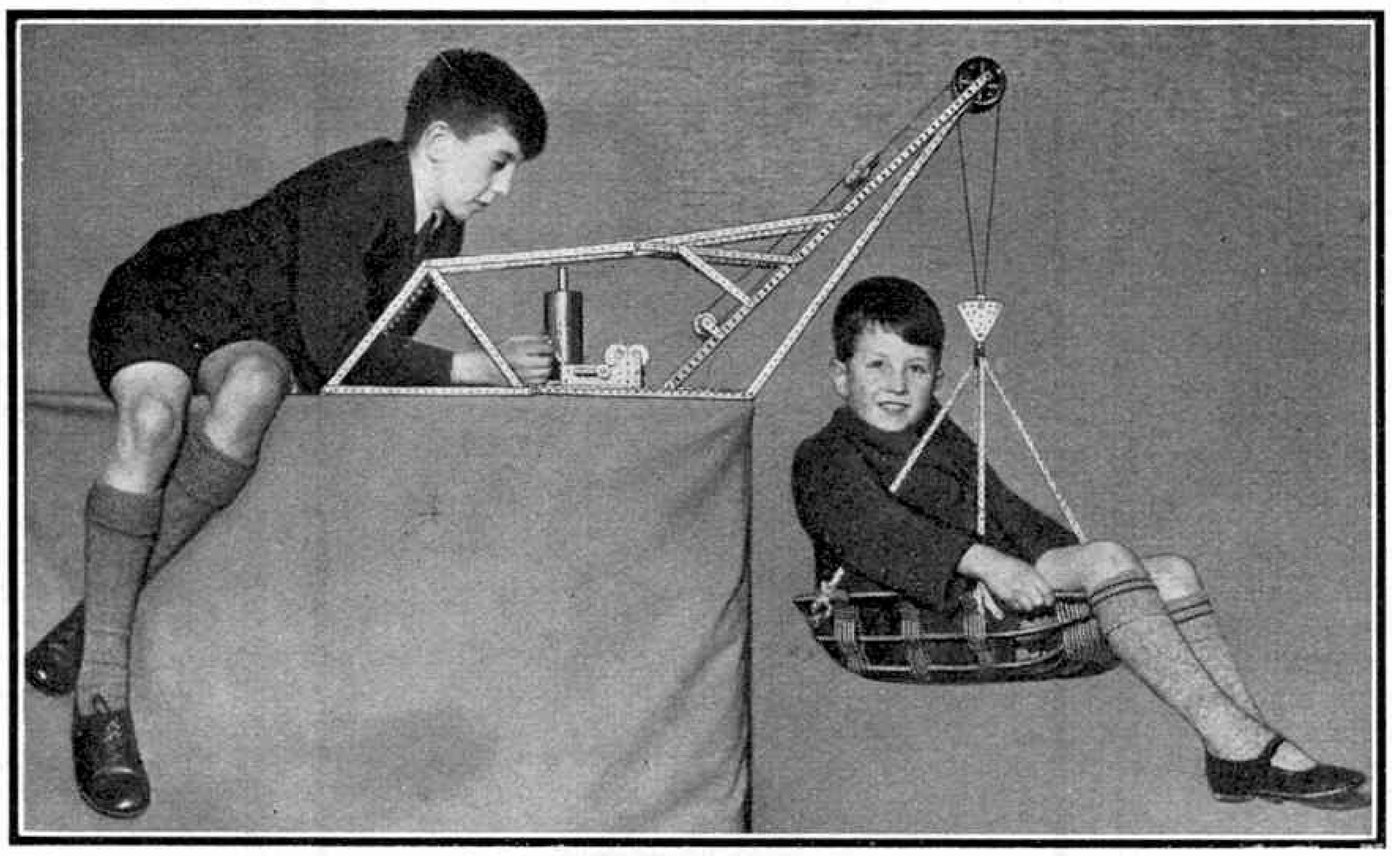
HEXAGON-HEADED BOLTS.—The round-headed bolts at present standard in the Meccano System closely resemble the rivets used in actual engineering structures, and it is generally agreed that they enhance the appearance of models. We cannot see that any advantage would be gained by the introduction of hexagonal or square heads; and such bolts would give a clumsy appearance to a model. In most cases it is easier to turn a bolt-head by means of a screwdriver than by a spanner. (*Reply to C. Hall, Farnham*).

ADJUSTABLE CRANK.—This suggestion is for a crank in the form of a disc provided with a boss and with a groove cut across its diameter. A Threaded Pin or Pivot Bolt forming the crank pin could be secured in any position in the groove. This is an ingenious idea and will be given consideration. (*Reply to W. F. L. Clement, Willington, Co. Durham*).

SMALLER BOILER.—A boiler of the same diameter as the present part, but only 2" in length, seems to have considerable possibilities. It might form an extension to the existing Boiler, or if fitted with an end, could be used as a crane bucket. We are filing this suggestion for consideration. (*Reply to J. A. Rodriguez, Montreal*).

CLOCKWORK MOTOR WINDING MECHANISM.—This suggestion is for a winding key that can be inserted through the standard Meccano perforation, thus increasing the adaptability of the Clockwork Motor in confined spaces. The idea is that the winding spindle should be much thicker than the existing spindle, and provided with a square hole cut longitudinally through its centre. The key, which would consist of a square shaft fitted with a handle, could be inserted in the Motor from either side. A winding shaft of this type if fitted to the Motor would increase the cost, but the idea is interesting and will be considered. (*Reply to R. Southwell, Sudbury, Suffolk*).

MECCANO STEAM ENGINE'S BIG LIFT



This photograph provides a remarkable demonstration of the power of the Meccano Steam Engine and the strength and rigidity of Meccano parts. The "engineer in charge" is Michael Robinson of Wakefield, and the passenger is his brother Brian. The total weight lifted by the Engine, including boy, basket and a 17 lb. lead weight, is slightly over 90 lb. Can any reader beat this record?

The best suggestion for a new or improved Meccano part sent in during the month of May was submitted by R. A. Gordon of Manchester, and the monthly prize of 10/– has therefore been awarded to him. The winning idea was for a semi-circular brake shoe casting for an internal-expanding brake.

GEAR RATIO OF 20 : 1.—The Worm (part No. 32), when meshed with a ½" Pinion, provides a reduction ratio of 19 : 1. Your suggestion that this ratio should be altered to 20 : 1 is interesting, but the alteration would necessitate a special 20-teeth pinion being supplied, and the advantages of a 20 : 1 ratio would not justify the change. A gear for use in a 5 : 1 ratio probably will be added to the Meccano range shortly, and this will make it possible to obtain your suggested ratio. (*Reply to H. J. Brown, Torquay*).

A NON-SLIP DEVICE FOR SCREWDRIVER.—A Collar with one end shaped to take a bolt head would be useful for fitting to the blade of a Screwdriver for a non-slip device. (*Reply to C. T. Geeson, Canterbury*).

IMPROVED BELL CRANK.—Your suggestion that the distance between the holes in the extremities of the arms of the Bell Crank and the hole through the boss should be increased, has distinct possibilities. The alteration would make it possible to secure a Strip across the end holes so that the part might be used as a Trunnion. If the holes were slotted it would be possible to achieve this result and at the same time retain the standard 1½" crank throw. The suggestion is receiving attention. (*Reply to A. Epprecht, London, N.8*).

DRIP FEED LUBRICATOR.—The suggested lubricator consists of an oil container provided with a small tap, and having a perforated lug attached so that it may be secured in position on a model. The flow of oil would be regulated by means of the tap. The suggestion is interesting, but it is possible to construct efficient lubricators from standard Meccano parts. An Automatic Drip Feed Lubricator for use in the Meccano Steam Engine appeared in the "Suggestions Section" of the "*M.M.*" for December 1930. Another useful form of lubricator, also recently dealt with in the "Suggestions Section," is of the Siphon Wick type, the oil being conveyed through wool encased in Spring Cord. These oilers are somewhat clumsy however, and we hope to make an announcement shortly concerning a more compact lubricator. (*Reply to R. Biddlecombe, Leigh-on-Sea*).

CATERPILLAR TRACK.—From your diagrams, we gather that your track would be formed from a number of small plates joined together by loops of wire to form a chain. A special cog for use with the track would engage with holes cut in the plates for this purpose. We are of opinion that a suitable form of caterpillar track can be devised by fitting special parts to Sprocket Chain, and we are at present considering suggestions of this nature. An ingenious track unit constructed from Strips and Chain is dealt with in the "Suggestions Section" of this issue. (*Reply to C. Leach, London, S.W.6*).

COMBINED THREADED BOSS AND SOCKET COUPLING.—The new part would consist of a threaded Boss fitted with a socket so that it could be attached to the boss of a Wheel or Crank. In such models as the Bendix Drive where space is at a premium, the suggested part would be useful, but very little more space is taken up by a unit consisting of a Socket Coupling and Threaded Boss. The selector groove in the built-up unit makes it of greater utility in a number of cases. We are nevertheless keeping your idea in mind. (*Reply to D. McDowell, Minster, Kent*).

IMPROVEMENT TO BRACED GIRDERS.—Two holes drilled in the ends of the Braced Girders might possibly increase the adaptability of the parts, and your suggestion will receive consideration. The narrow strip across the ends of the Girders would be widened to the width of a standard Strip and the bracing would be altered accordingly, so that the parts would not make such a neat join as the present Girders. The increased uses might outweigh this disadvantage, and we shall keep your idea in mind. (*Reply to W. Welsman, London, W.9*).

FLAT SECTOR PLATE.—It seems to us unlikely that many practical uses could be found for a flat sector plate that could not be filled adequately by existing parts. Can you suggest any such uses? (*Reply to E. Mace, Talgarth*).

Unusual Types of Aircraft—(*Cont. from page 559*)

the angle of the aeroplane itself, they always lie floating in the wind. As the stalling point is reached—in so far as the machine may be said to have a stalling point—they are still available for control purposes, as they lie in what may be termed a neutral position. The result of this is that the machine sinks gently downward under conditions when an ordinary aeroplane would crash. When operated together the controllers act as elevators, and they play the part of ailerons when used differentially. The peculiar construction of the machine and its behaviour when in conditions that would cause an ordinary aeroplane to stall makes it possible to restore normal flight without recurrence to diving. Thus the change may be made without rapidly losing height, a great advantage when operating near the ground.

The rudders of the machine also are novel in type. They are mounted below the wing, one on each side, and normally they trail freely in the wind. When it is desired to turn the machine to the right, the rudders on that side are turned across the line of flight and the resistance it then offers to the airstream produces the desired effect. It is interesting to note that they may be swung across the wind simultaneously. Then they act as an air brake and consequently make the gliding angle steeper.

Work is now proceeding on a three-seater cabin aeroplane that will incorporate additional features that are expected to improve the flying qualities of this type of machine. The future development of the "Pterodactyl" will be followed with great interest.

A very interesting effort to produce a machine in which flying shall be safer also has been made in Germany by the Focke-Wulf Flugzeugbau A. G., Bremen. This type of machine is called the "Ente," which simply means "duck," and it is decidedly unusual in appearance, for when in the air it seems to fly backward. This is due to the position of the main wing, which is at the rear of the machine. A small plane carrying the elevators is fitted in front. The angle of attack, or angle made by the wing with a horizontal line in the direction of travel, is greater for this small plane than for the main wing. When the machine is climbing, therefore, the small front wing reaches the stalling point earlier than the main wing, and thus the latter can never get into a stalled position.

The general design of the machine also makes it impossible to take it into a spin or nose dive. An important factor in this respect is the position of the centre of gravity, which naturally is some distance in the rear of the small leading plane. The machine is also safer on the ground than normal aeroplanes, for its centre of gravity is behind the front wheel and it cannot be made to nose over no matter how hard or how suddenly the wheel brakes may be applied. Another interesting point is that the occupants of the "Ente" are well protected in the presumably unlikely event of a crash, for the brunt of the collision with the earth that would then take place would be borne by the long forepart, and the effect of this would be to reduce the seriousness of the impact to the rear section in which are accommodated pilot and passengers.

The "Ente" machine has been subjected to a number of flying tests and has given very promising results. Its performance figures are not particularly good, but these will no doubt be improved as greater experience with the new design is obtained.

The Focke-Wulf "Ente" has an overall length of about 34 ft. 6 in., while the span of the main plane is 32 ft. 10 in. and that of the forward plane 16 ft. 5 in. The total tare weight is 2,585 lb., while the disposable load is 1,045 lb. and the gross weight 3,630 lb. The maximum speed of the machine is 88 m.p.h., while it cruises at 80 m.p.h. and lands at 52 m.p.h. The climb to 3,385 ft. is completed in 8.3 minutes. Two Siemen and Halske Sh-14 type engines are fitted and each of these develops 110 h.p. They are carried in nacelles on each side of the fuselage. The cabin seats four persons and is surprisingly quiet, this being no doubt due to the fact that the airscrews are behind it.

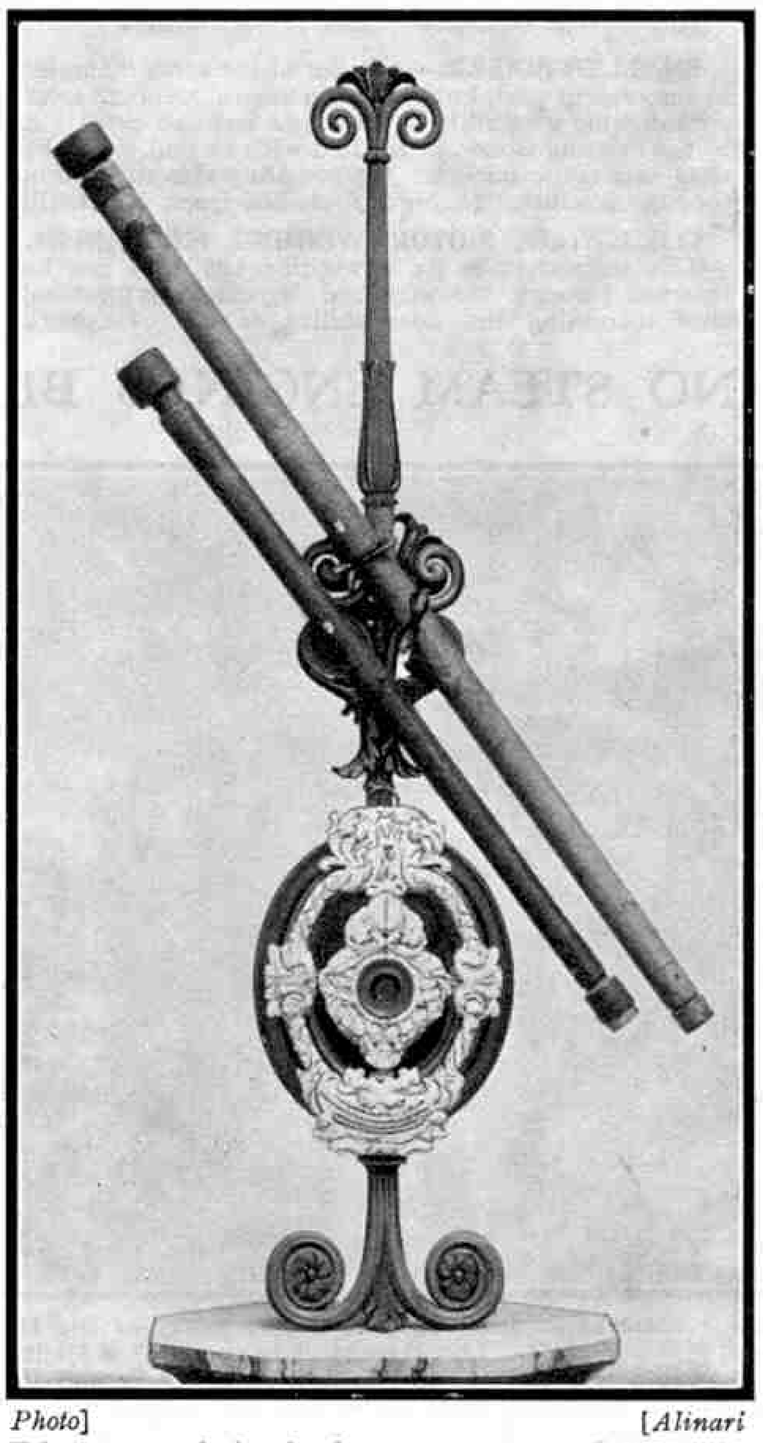
For our last example of unusual aeroplanes we turn to the United States, where an interesting machine of the "pusher" type recently has been designed by Mr. Stout, of the Stout Engineering Laboratories, who are responsible for the technical and development work of the aeroplane division of the Ford Motor Company. This is called the Stout "Sky Car" and is an aeroplane of the cantilever high-wing monoplane type. It is fitted with a 75 h.p. Rover engine that is inverted and air-cooled, and has its four cylinders in line. There is accommodation in the cabin for two persons, one of whom sits behind the other.

As our photograph of this aeroplane shows, the cabin is attached to the empennage or tail wing, by means of bracing booms. The engine is mounted directly above the cabin and is behind the booms.

Although it is separated from the accommodation for the pilot and passenger by a fire-proof bulkhead and a sound-proof wall, it seems to be in a position that may give rise to several dangers. Mr. C. G. Grey, Editor of "*The Aeroplane*," has pointed out that the tail-booms would be cut if the airscrew were broken and this would undoubtedly have disastrous results. He also remarks on the uneasy feelings of the occupants of the machine on reflecting that in the event of a crash they would be crushed between the engine and the ground and would have very little chance of escape. There would also be grave risk of leaking petrol being ignited by the engine. It is probable that airscrews of the pusher type will be more largely used in future than at present, but better positions must be found for them than that provided for in the Stout "Sky Car."

The quaint appearance of this novel American machine is well shown in the photograph that appears on page 559. It is fitted with a wide track undercarriage of the split-axle type and is equipped with wheel brakes that may be used independently or simultaneously. The overall span of the "Sky Car" is 43 ft., the length 23½ ft. and the height about 6 ft., while its total weight is less than 1,000 lb.

Galileo's Early Telescopes



Photo] [*Alinari*

Telescopes made by the famous astronomer Galileo, and now in the Museum of Physics and Natural History, Florence. The story of the refracting telescope was told in last month's "M.M."

Famous Inventions—(*Cont. from page 537*)

mounted on a ball and socket joint, and was slung by chains between two masonry walls 23 ft. apart, 50 ft. in height, and 70 ft. in length. The telescope was of the Newtonian type, the eyepiece being at the side and near the top of the tube; and the observer used it from a series of galleries and sliding stages. The instrument was sufficiently powerful to bring the Moon to an apparent distance of 40 miles, but this great magnifying power could not be successfully used to the full on account of atmospheric conditions.

In 1856 Steinheil proposed that glass discs ground to the required curvature and silvered on the curved side should be used instead of metal for the mirrors of reflecting telescopes. The first silvered glass mirror was made in 1879, and this type has now completely superseded the metallic speculum. Its chief advantages over the metallic reflector are that it reflects nearly twice as much light; and that when it becomes dull it can easily be re-silvered, instead of having to undergo repolishing.

The largest reflecting telescope of the present day is the 100 in. instrument of the Carnegie Observatory, Mount Wilson, California, and we shall describe this and other famous modern telescopes in a future issue.

Branch Notes

MAIDSTONE.—The Chairman gave a very interesting talk on the Sykes Block System, which is used at Maidstone East and other neighbouring stations. A photographic competition is being held for which each entrant must submit two photographs, one of a real train and the other of a model train. The photographs will be judged on their similarity, not so much as regards the locomotives, but in regard to the general setting. An outdoor railway is being established. Secretary: S. C. Wicks, 24, Marion Crescent, Plains Avenue, Maidstone.

SOLIHULL.—The Branch members paid a visit to Messrs. Cadbury's Works, which included a tour by charabanc round Bournville village. A visit has also been paid to Tyseley Locomotive Sheds, where the members met the Olton Branch who were also being taken over the Sheds. The boys were allowed on the footplates of several locomotives and also inside the smoke-boxes of one or two. Great interest was shown in some engines that were being overhauled. Unfortunately, owing to bad weather conditions, it was impossible to take photographs. Secretary: H. A. S. Aitken, "Cardross," Broad Oaks Road, Solihull.

FIRST EDINBURGH.—A permanent track has been installed, the shelf on which it is laid down being built around three sides of the club room. Official railway forms have been purchased from Headquarters and the railway is operated with the aid of these. Four sections have been formed, each representing one of the four railway groups, and keen rivalry exists between them. Tests have been held to test the speed, endurance, hauling power and steady running of the Branch locomotives of which there are about 45. This large number is found useful when "rush hour" services are tried out, as many as 10 engines being in operation at the same time. Regular visits to the two main stations at Edinburgh are paid by the members. Secretary: J. A. Gower, "Fairhaven," Russell Place, Trinity, Edinburgh.

BOLSOVER AND DISTRICT.—A very interesting Branch track has been laid, which includes four stations, two being terminal stations. A large goods yard is attached to each station. At a recent meeting some interesting double-heading was carried out, and members were thrilled at the sight of an express goods train bearing the correct lamp code go rushing through a station while the shunting engines were drawn into the sidings to allow it to pass! A talk entitled "*From Euston to Carlisle*" was given by the Chairman, and this was found particularly interesting, as the Chairman described in detail what could be seen from the carriage window. Extensive experiments have been made in giving a locomotive the correct number of winds to make it stop of its own accord at a desired spot. Secretary: John L. Lee, Mooracre Lane, Bolsover, Nr. Chesterfield.

Members of the Maidstone Branch, No. 142. Chairman, Mr. E. Wicks. Secretary, S. C. Wicks. These boys are so keen that they meet at least six times a month either for track meetings or for visits to places of railway interest.

GLOUCESTER.—A very interesting lecture was given by Mr. J. Roberts, an ex-L.M.S.R. goods guard. The lecture dealt with every aspect of a guard's duties, and was illustrated by many interesting anecdotes of Mr. Roberts' experiences in the early days of the Midland Railway. After two years hard work as Branch Secretary, during which time the Branch has made steady progress, G. T. Clark has been obliged to resign his position owing to other demands on his time. The new secretary is K. Barrow, 22, Painswick Road, Gloucester.

FIRST BOLTON.—During the summer track meetings are being held in a large garden. The main terminus is laid on the lawn, and a realistic main line is carried through a rockery where cuttings have been made. The usual visit to Lostock Junction took place, and a large assortment of passenger and freight trains were seen. A train that is always watched for is "*Heysham Boat Express*," which roars through each evening at 9.40 p.m. It is usually hauled by a Midland Compound, and consists of 11 corridor coaches and a dining car. Secretary: Arnold Ainley, 11, Stirling Road, Astley Bridge, Bolton.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

ASHBOURNE—L. H. Thomas, North Avenue, Ashbourne, Derbyshire.

LISBURN—E. Boyd, "Altona," Wallace Avenue, Lisburn, Ulster.

NEW BARNET—B. G. Brockis, "Runton," Clifford Road, New Barnet.

SKEGNESS—A. G. Osborn, Lumley Lodge, Skegness.

SWINDON—Mr. Walter Cowlishaw, 18, Holbrook Street, Swindon, Wiltshire.

WATFORD—F. Canvin, 40, Bedford Street, Watford, Herts.

WORTHING—P. Feltham, "Boharn," 127, Dominion Road, Worthing.

OVERSEAS

AUSTRALIA—Allan Dempster, "De-Aar," King Street, Warwick, Queensland.

INDIA—Mr. J. Ranji, 2/99, Pedarian Pegovia Street, George Town, Madras.

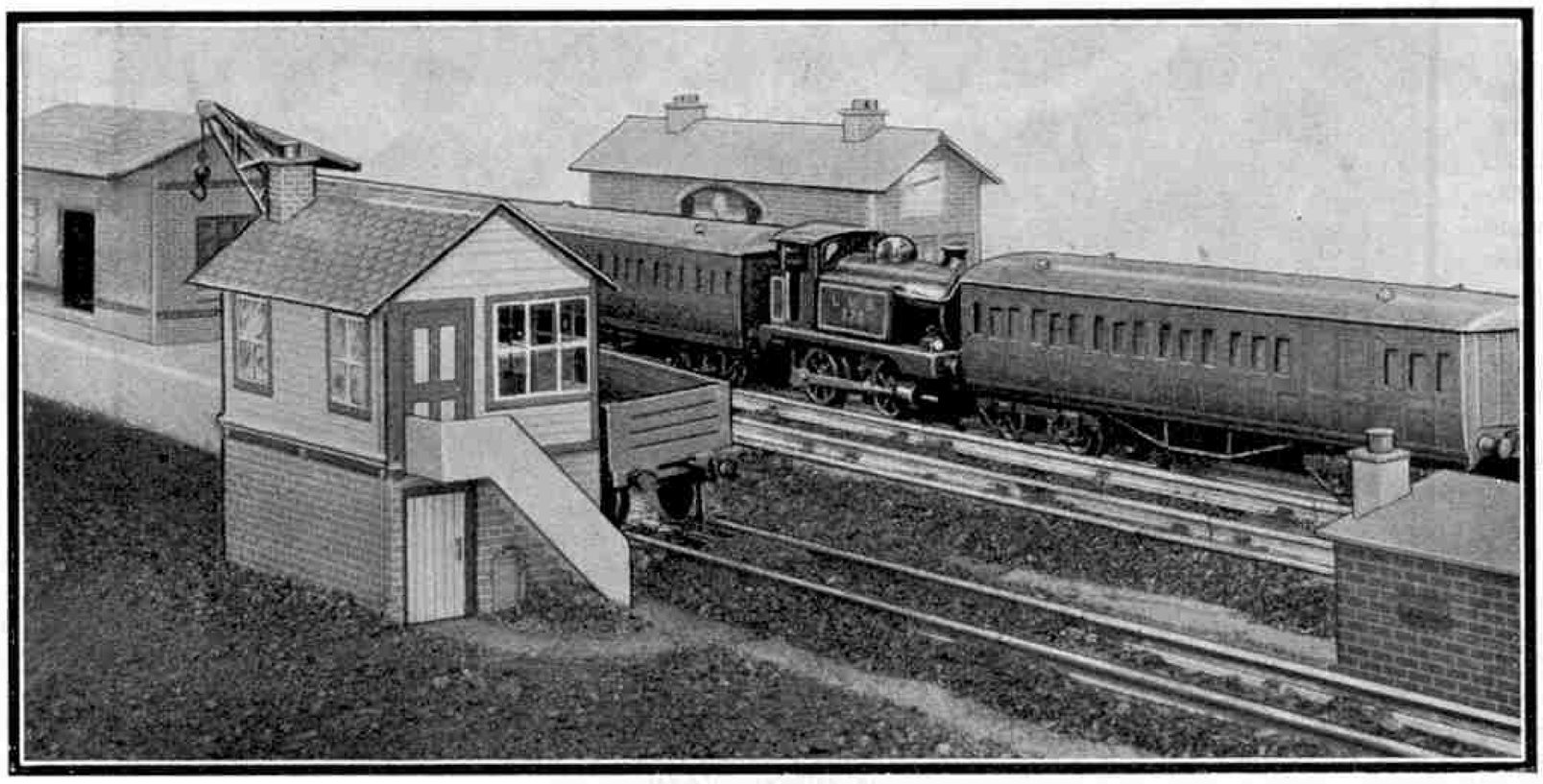
Further Incorporated Branches

176. FIRST BOLTON—Arnold Ainley, 11, Stirling Road, Astley Bridge, Bolton.
177. DOWNS PARK (BRISTOL)—A. S. Lomax, 58, Downs Park, E., Westbury Park, Bristol.
178. WALDEGRAVE HOUSE SCHOOL—P. D. M. Pope, Waldegrave House School, East Grinstead, Surrey.
179. PLUMSTEAD MODEL RAILWAY CLUB—J. Fortune, "Fernbank," Grosmont Road, Plumstead, S.E.18.
180. COMELY BANK (EDINBURGH)—H. W. Govan, 35, Comely Bank, Edinburgh.
181. BOGNOR REGIS—Raymond S. B. Knowles, "Cliftonville," Canada Grove, Bognor Regis, Sussex.
182. CROSSGATES (LEEDS)—Peter Breckin, 22, Marshall Terrace, Crossgates.
183. SLOUGH AND SOUTH BUCKS—Mrs. F. E. Hare, "Wyleigh," Windsor Rd., Slough.

XXXI.—BRANCH LINE WORKING ON HORNBY LAYOUTS

MOST model railway owners are always keen to try any fresh operations that may be possible, and a great advantage of a layout that has to be put down afresh when required is that the same arrangement of rails need not be followed every time. Thus experience is gained according to the success or otherwise of the various schemes that are tried, and this is extremely useful. Many features of model railway operation have been dealt with in the "*M.M.*" and we think that branch line working will be a welcome subject. It will no doubt be new to many, and train working may be made very interesting by the varied possibilities afforded.

Most junior enthusiasts employ the oval form of layout, on which one or more stations may be situated. A branch line can easily be led from one of these stations to another part of the room, or even into another room, and may be terminated quite simply. A "halt" may be placed on the way, and for this the Wayside Station of the "M" Series is specially suitable. The track formation of the branch line will depend of course on the rails available, and to some extent also on the method of working adopted for the branch train.



A motor-train at a branch line terminus. The engine is placed between the coaches, an arrangement that allows either coach to be detached as required without shunting.

At the main station or junction where the branch leaves the main line, the branch train may use the same platform as the main train. If this is the case, points will be placed near the end of the platform, and the branch line will lead off in the direction selected. This arrangement is suitable, but it has the disadvantage that the branch train cannot use the platform while the main line train is waiting there; and similarly the main line train is liable to delay from the branch train. As it is often the practice in real railway working to accommodate branch trains in a bay platform at a junction station, it may be considered worth while to do this on a miniature layout.

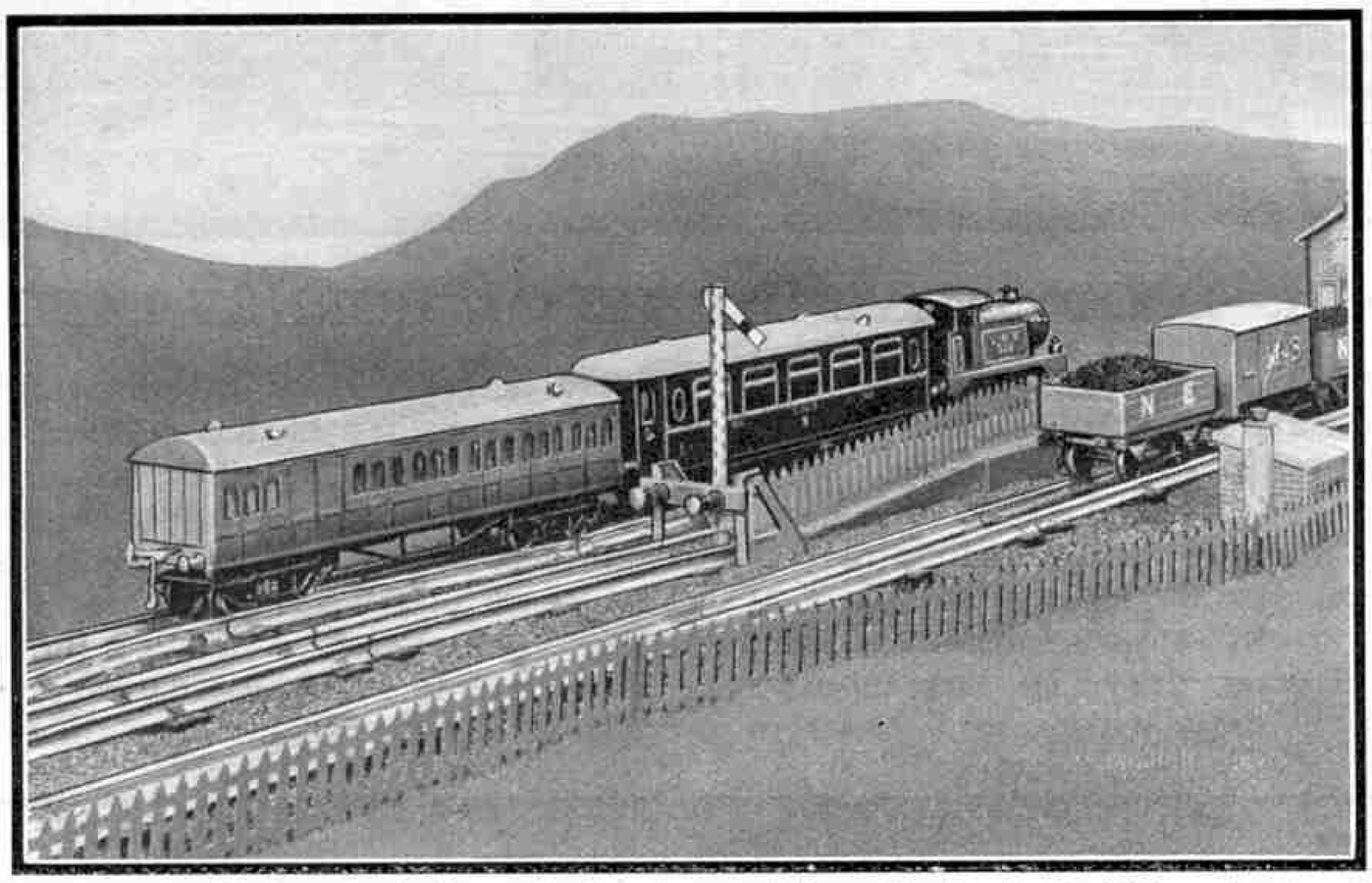
If the Hornby No. 2 Station is employed, it may be extended by means of a section of Passenger Platform, and the branch line train may be accommodated at the back of this. The Paled Fencing that is provided with these platforms will of course be removed. Connection with the main line is necessary in order that through working from the main line to the branch terminus will be possible. This may be carried out by means of points, or possibly a crossover, whichever happens to be more suitable in the particular circumstances. It should be remembered that where a crossover is employed the platform cannot be placed between the tracks unless these are set further apart beyond the crossover by means of reverse curves. For this reason the use of independent points is perhaps the best way to settle this matter.

The branch line itself may consist of single track throughout, except perhaps at the terminus. If the branch train consists of an ordinary train, made up of perhaps two or three coaches and a guard's van hauled by a No. 1 Tank, the engine will require to run round its train on arrival at the terminus. This means that a loop line must be included, but no odd vehicles can be left on it as they will be in the way of the engine when this requires to run round its train. Similar arrangements will have to be made at the junction station, whether the branch train uses the main line platform, or is dealt with in a bay platform as previously described.

In order to avoid the necessity for these reversing loops, branch traffic may be dealt with by what is known as a "motor-train." This may consist of a single Metropolitan Coach and a No. 1 Tank Locomotive. In one direction the journey is made with the engine leading, and in the other the coach is pushed by the engine. The particular coach used should preferably be the composite one having a pair of luggage doors and a guard's compartment at one end. The end compartment may then be supposed to represent the driving compartment from which, in actual practice, the locomotive is controlled when the coach is leading. When this is the case the

driver travels in this compartment, but the fireman remains on the footplate of the engine. When travelling with the engine leading, the train is of course operated in the normal way.

If a branch line is only small, or if little traffic is dealt with upon it and the staff is limited, tickets are frequently issued and collected by a conductor while the train is in motion. A corridor coach is of course necessary to enable him to do this, and one having a passage down the centre may be used. Such coaches are also employed sometimes as trailers, in addition to the driving coach, when a two-coach motor-train is in service. A good representation of this may be obtained on a Hornby layout by making use of one or other of the No. 2 Saloon Coaches, as shown in one of the accompanying photographs, where a branch line motor-train made up in this manner is seen leaving the station.



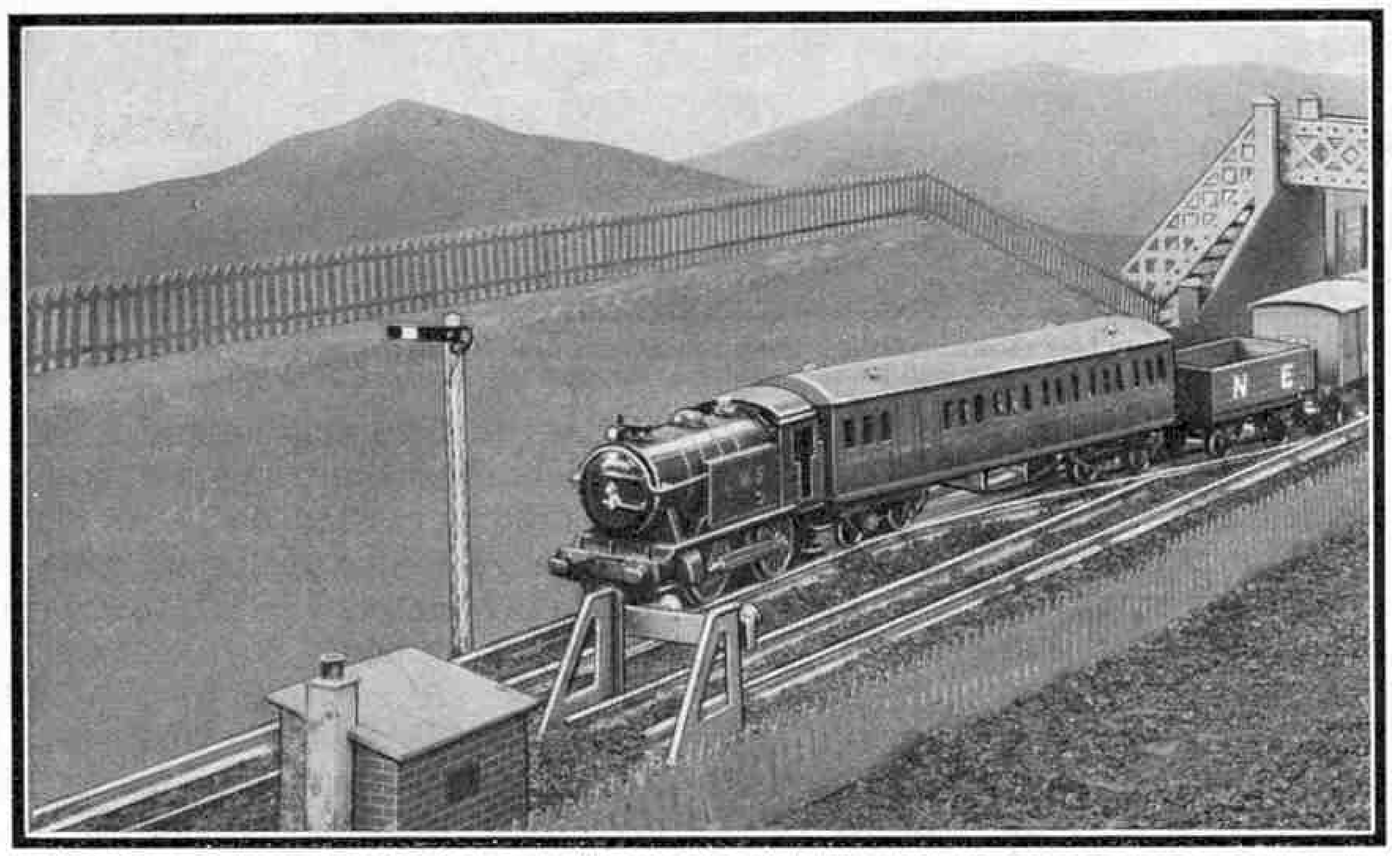
A motor-train with the engine in the rear leaving a branch station. The Hornby No. 2 Saloon Coach used as a trailer represents the pattern of vehicle with centre corridor often seen on such services.

A further variation is to be found in the make-up of a branch line motor-train. Instead of the engine leading in one direction and trailing in the other, a two-coach motor-train may be arranged with the engine between the driving coaches, where it looks decidedly strange. An advantage of this is that half the train, either in front of or behind the engine, may be disconnected when not required, without the necessity for carrying out any marshalling work. This scheme of placing the engine in the middle of its train may be followed quite well on a miniature line, and the unusual appearance of such a train is bound to create interest on the part of all who see it, as may be judged by the photograph on the previous page.

A feature of many branch lines on which little goods traffic is dealt with, is the survival of the old practice of running mixed trains. These consist of both passenger and goods vehicles, the latter being marshalled in the rear so that the brakes are available throughout the passenger portion of the train. This mixed working may be readily carried out in miniature, and it provides an easy means of dealing with goods traffic on a small branch line. In order to dispose of the wagons on the arrival of the branch train, a small loop line is desirable at the terminus. The wagons will be shunted back on to this after the passengers have been dealt with, and may be left there until required to work back on to the main line. Great fun is to be obtained by arranging through wagon loads of goods to be worked from the main line over the branch line, and in the reverse direction wagon loads may be made up for transfer to the main line at the junction. If desired, through coach working also may be carried out, a No. 1 Coach perhaps being detached from the main train at the junction, and taken on to the terminus by the branch train.

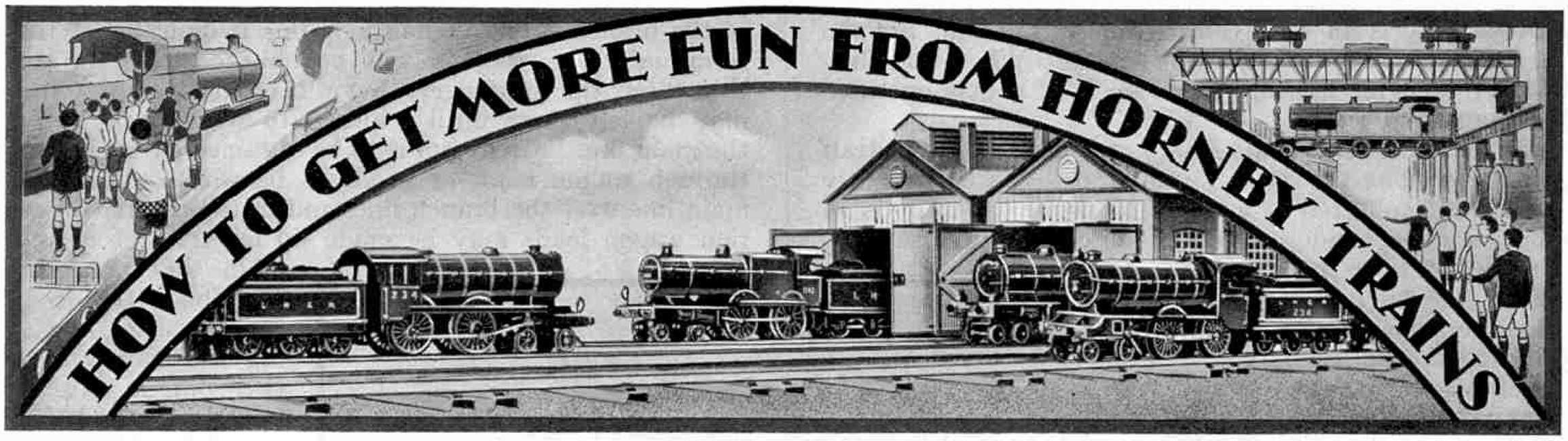
It will be realised, therefore, that the reproduction of the working conditions of a branch line is an easy matter, for the amount of stock and equipment necessary may be very small indeed without the interest of the line being affected. This is decidedly an advantage, especially for those who have little space in which to lay their railways, and whose rolling stock and equipment generally is limited, so that the practice should have a special appeal to junior model railway owners.

Many branch lines have a single track throughout, and frequently stations are very small. In places only a halt consisting of a shelter on a small platform will be provided, and the only signals used will be at the junction and at the branch terminus.



Mixed train operation on a Hornby Railway. Goods vehicles are frequently attached to passenger trains on branch lines and in remote districts where traffic is scarce.

Some junior railwaymen may perhaps have been doubtful as to the success of branch line working, owing to the comparatively few items that need be used. When they have followed the various hints given here, however, we are sure that they will be convinced of the fun to be obtained from the operation of a small branch line, and will be eager to try out its possibilities on their own railways. They will probably be surprised at the realistic effects it is possible to obtain so easily. Main line expresses and their working are extremely fascinating, but their successful representation on a small scale depends a great deal upon their surroundings. A simple track and equipment, however, allows the working conditions of a branch line train to be reproduced without trouble.



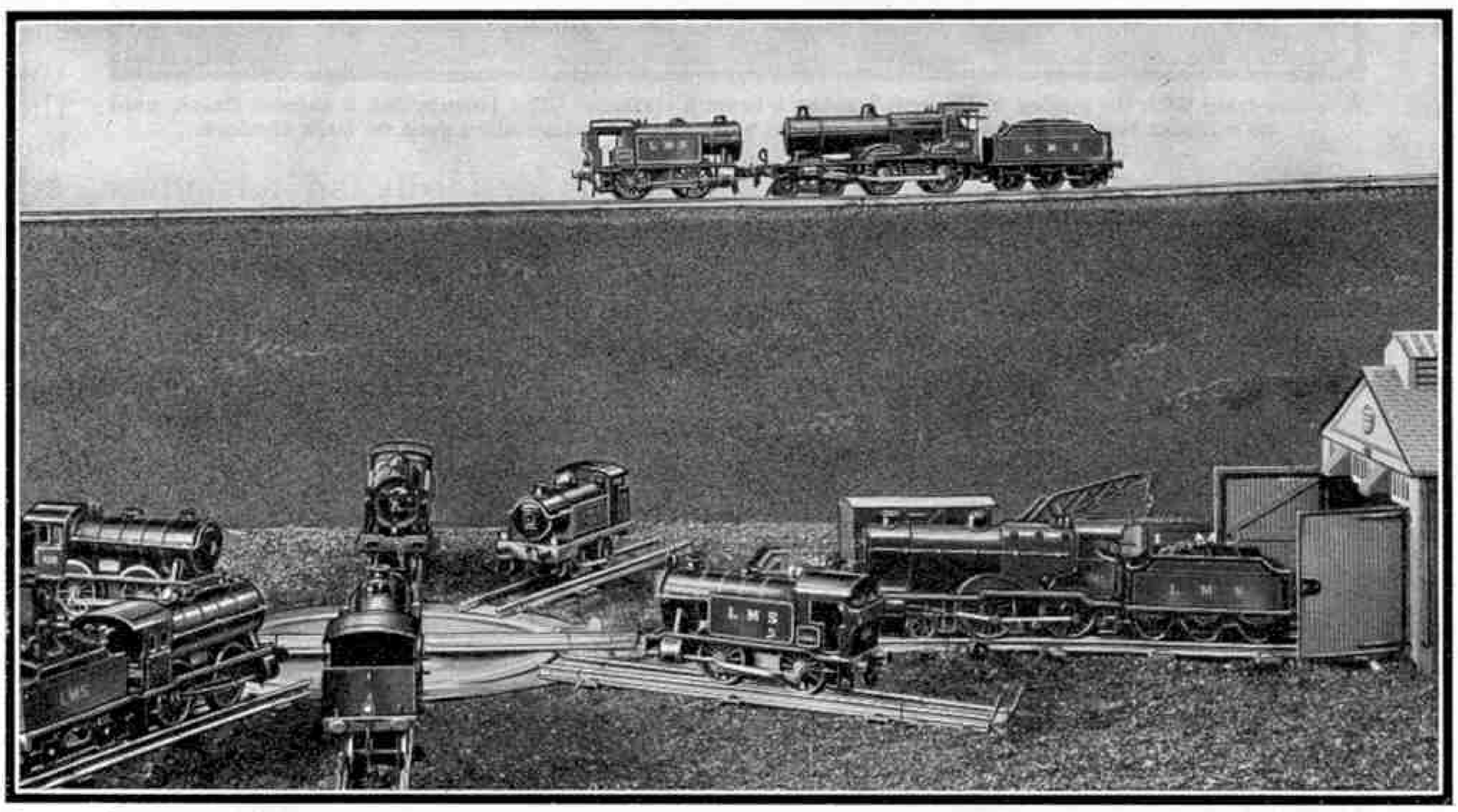
XXXIII.—LOCOMOTIVE DEPOTS ON HORNBY LAYOUTS

PROBABLY most Hornby enthusiasts will agree that some of the most attractive operations in the working of a model railway may be carried out in connection with the engine shed. The shed is indeed one of the most interesting features of both real and miniature railways; for it is there that we see the engines "at home," and in various stages of preparation for their day's work or disposal after duty. In last month's "*M.M.*" we dealt with the classification and duties of Hornby locomotives, and this month it will be of interest to consider the formation and placing of locomotive depots on Hornby layouts, and the various operations that may be carried out in and around them.

Engine sheds are of two main types. The first has a number of straight parallel tracks running from end to end and is known as a "straight-road" shed; the second is the "round-house" shed, where a central turntable is installed from which the various lines radiate. Round-house sheds are unfortunately not very suitable for small model railway layouts, owing to the large amount of space that they occupy; but in some respects they are even more interesting than the straight-road type.

The number of engine sheds on a model railway is governed by the size of the layout and the number of locomotives. It is desirable that every large station should have a locomotive depot attached to it, but this is rarely possible owing to restrictions of space. As readers will be already aware, the accommodation afforded by a Hornby Engine Shed may easily be increased by the addition of another Shed placed either alongside so as to double the number of roads, or end to end with it on the same track so as to increase the length of the depot. Thus the main features of any real locomotive depot with which the owner is familiar may be reproduced without much trouble.

The number of locomotives allotted to each shed should be such that they are all under cover, or at any rate the best and the most recent ones. They are thus protected from dust, and this is one of the main purposes of the Hornby Engine Shed. If the number of locomotives increases so that it is impossible to accommodate them all, it should be carefully considered whether to extend the shed by either of the methods just mentioned, or to introduce a new shed elsewhere on the layout. A plan that is favoured by many Hornby enthusiasts is to have one shed for passenger engines and a separate one for goods engines. This scheme is extensively employed on real railways, for it is more convenient to have the locomotives separated in this manner. It has much to recommend it on a model railway where considerable shunting, marshalling, and goods working generally is carried out. As a rule, however, a certain amount of mixed traffic working has to be performed in arranging the duties of the various engines, and this makes it difficult to separate the locomotives satisfactorily. A solution to this difficulty is to keep the express engines only apart from the others, when the latter will be available for goods or mixed working, according to their capacities or the requirements of traffic.

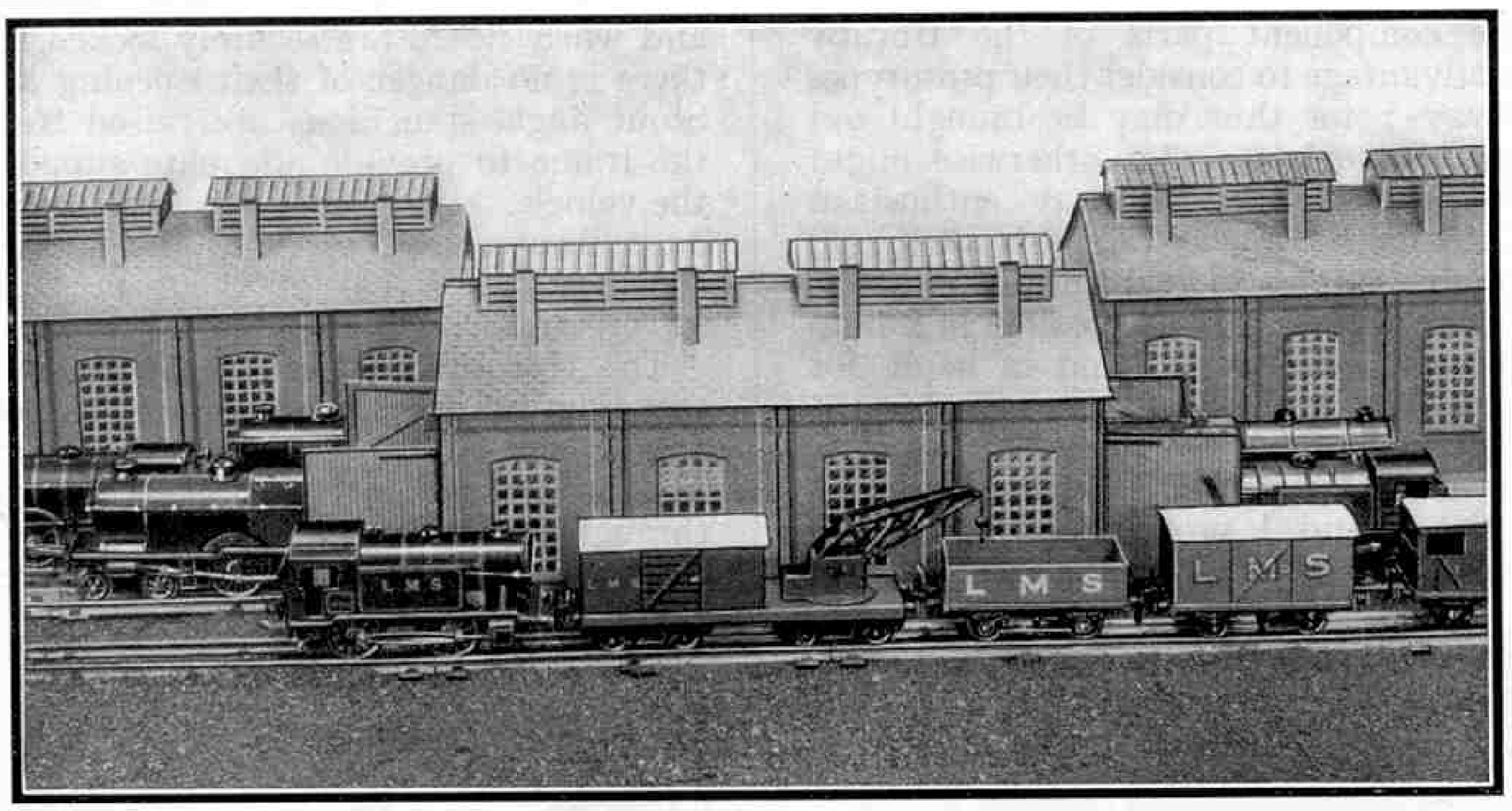


Locomotive storage sidings are here shown radiating from a turntable as described in this article. The layout of the roads in a "round-house" shed may be similarly arranged.

Engine sheds should always be placed so that they are easily accessible from the station they serve, thus obviating unnecessary shunting, and consequent blocking of the main line, in order to allow engines to reach the station. If goods working is a prominent feature in the operation of the railway, and a marshalling yard is incorporated, perhaps some distance away from the main locomotive depot, it will probably be advisable to place the shed near the yard so as to enable the locomotives to

be near at hand and thus reach the sidings easily.

Where space permits, the features of a round-house may be reproduced fairly easily by making use of the Hornby No. 2 Turntable, and arranging ordinary straight rails to radiate from it. Buffer Stops may be placed at the end of each road if desired, but it is not usual to have these at the ends of the roads in a round-house, as they take up a large amount of space. A method that is often employed is to make use of triangular stop-blocks made of iron clamped to each rail. A similar effect may be obtained by bending Hornby Rail Connecting Pins and inserting these at the ends of the rails. They will look quite realistic, and will also prove effective as stop-blocks. An example of the use of pins bent in this manner may be seen in one of the accompanying photographs.



Breakdown cranes are usually attached to large locomotive depots. The Hornby breakdown train in this photograph is about to leave in charge of a No. 1 Special Tank.

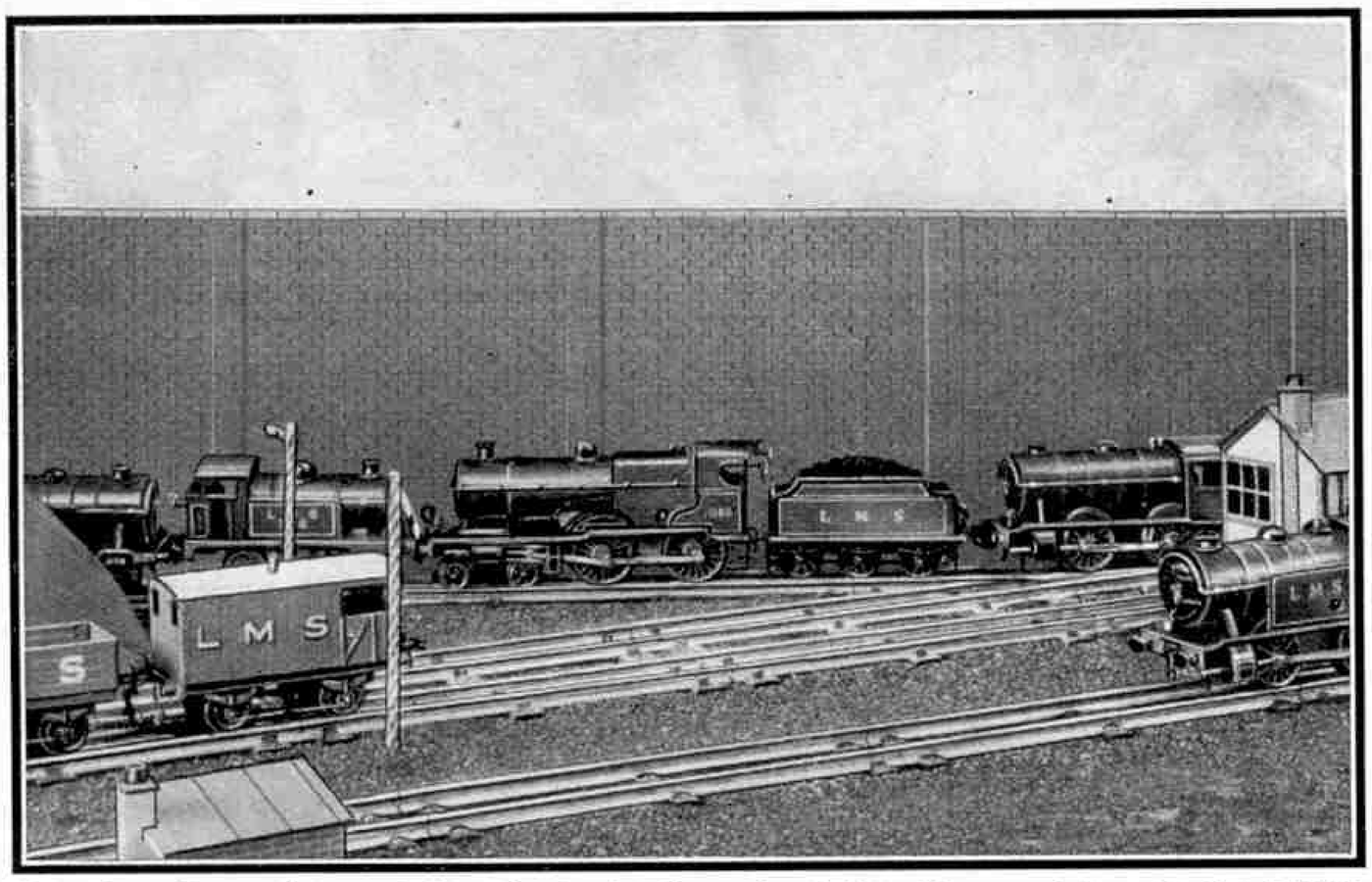
When the layout of the rails in the round-house has been finally decided upon, the extent of the space occupied should be measured, and the building may then be constructed of wood or cardboard, either circular or, strangely enough for a "round-house," rectangular in form. The roof may be built of cardboard, and it is important to see that the smoke outlets are placed in a circle, and that they are above the chimneys of the locomotives stationed below. There should be an opening at one side to allow the engines to enter or leave the shed. If two openings are required, they should if possible be at opposite sides, so that a straight road is available through the shed. Engines should not be stabled on the incoming or outgoing roads, as they would then be in the way of other locomotives requiring to enter or leave the shed and thus would cause considerable delay.

Engines should always be brought to a stand before proceeding into the shed, so as to ensure that the turntable is in the correct position. This will prevent the possibility of any mishap occurring, and in order to warn the enginemen the notice boards "Shut off Steam," or "Caution," may be placed in suitable positions outside the shed where they will look very effective.

Round-house layouts may also be extended in a longitudinal direction by the addition of another turntable and radiating tracks. If this is done the turntables may be connected by a length of straight rail, and the building made of similar form to a straight shed with the entrances at opposite ends. The appearance of a number of locomotives standing round the turntable in such a shed is very realistic. It is important that the locomotives should all face towards the turntable, as is usual in actual practice, so that their chimneys will then be under the smoke ducts.

One of the accompanying photographs shows locomotive storage sidings arranged to radiate from a turntable in the same manner as the roads in a round-house shed, and the layout therefore may be used in such a shed. Storage roads of this kind are frequently seen outside a round-house, and are often used for accommodating "foreign" engines, that is engines belonging to other depots that are waiting to perform their return trip. These would normally stand in sidings near the shed in the case of a straight-road layout.

A round-house shed would be very suitable for a Hornby layout where tank engines only require accommodation. If these were used in connection with frequent local services on a line chiefly operated on "intensive" principles, the ready mobility of an engine in the depot would be a strong point in favour of the round-house.



A number of locomotives coupled together leaving the engine shed yard to proceed down the line to their work. Such groups of locomotives are a familiar sight in the neighbourhood of most depots.

A feature of all large locomotive depots is the breakdown crane attached to it. These cranes are steam operated, and sufficient pressure to work them is always maintained. The breakdown train of which they form a part is usually kept in a special siding or road in or near the shed, so as to be ready instantly if required in a sudden emergency. Readers will no doubt be familiar with the formation of the train itself. The crane is invariably accompanied by a "match truck" on which the jib of the crane rests.

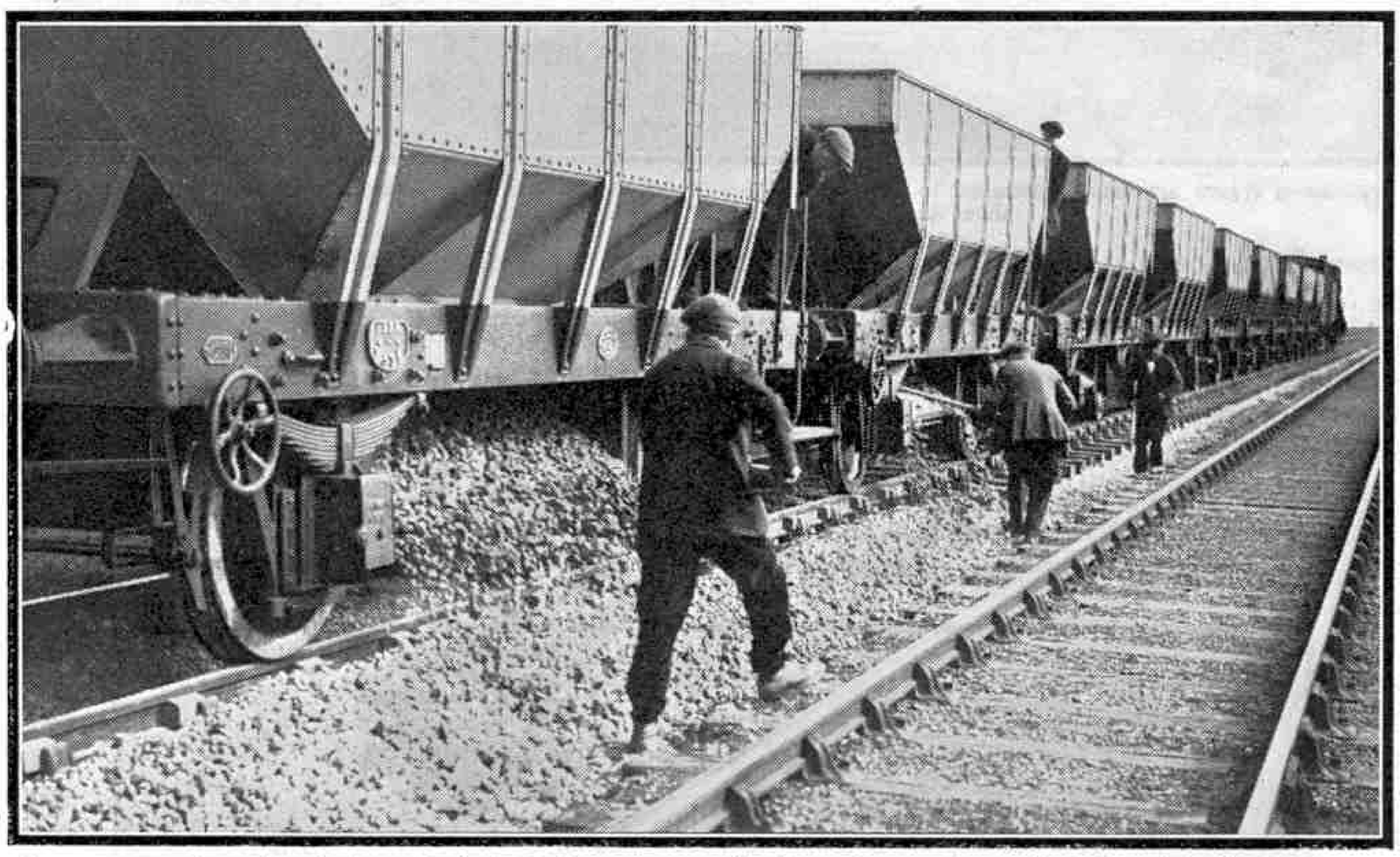
(*Continued on page 607*)

Hornby Series Contractors' Wagons

By "Tommy Dodd"

IN reviewing the component parts of the Hornby System it is of advantage to consider their prototypes on actual railways; for thus may be brought out interesting features of the latter that otherwise might pass unnoticed by the Hornby Railway enthusiast. The whole aim in the model railway hobby is, or should be, to study the main features of real railway practice, and then to reproduce them as far as possible in miniature. The two interests always go hand in hand, for without a knowledge of actual railway practice the full value of models cannot be appreciated.

Much of the Hornby rolling stock has been described already in these pages, and I propose this month to give special notice to those wagons that incorporate some mechanical movement. These vehicles come under the general heading of contractors' wagons, and they include hopper, rotary tipping, and side tipping wagons. Such wagons are used extensively by engineering firms and also by the railway companies themselves in carrying out all kinds of work in connection with the construction, repair and extension of buildings of various kinds, bridges, tunnels, embankments and cuttings; and each vehicle has been designed to serve a special purpose in connection with this work.



Hopper wagons in use in actual practice for ballasting purposes. Similar wagons are frequently employed for the conveyance of coal for locomotive depots, power houses and similar establishments.

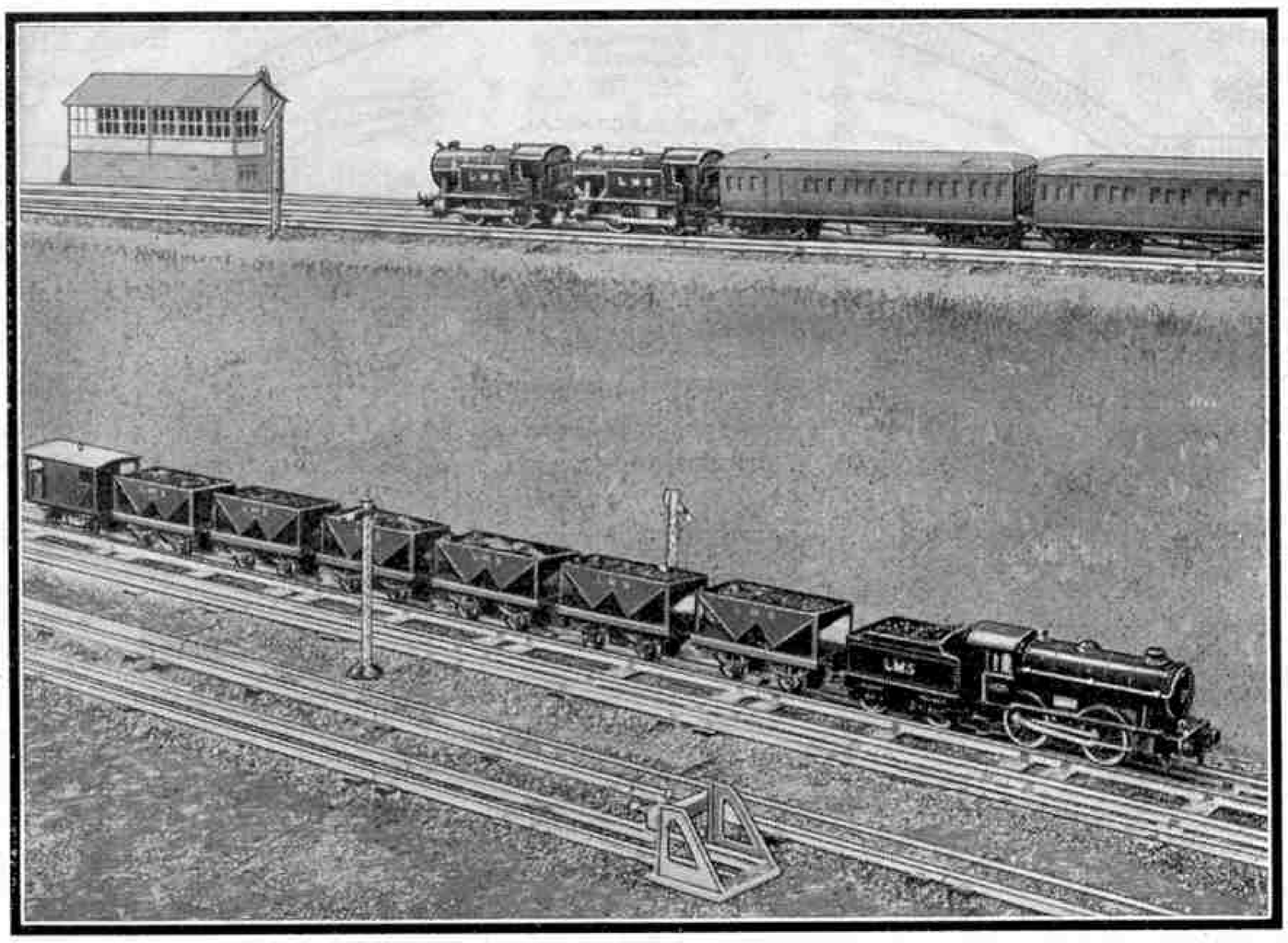
First let us take the hopper wagon. This is employed when material is required to be tipped between the rails; and it then operates as a self-discharging wagon by means of doors in the base or floor. Such occasions occur when ballast has to be laid, or when coal has to be discharged into chutes at locomotive depots. In the latter case the track is laid on a gantry with openings between the rails. Other users of hopper wagons are electric power stations, gasworks and similar establishments at which coal is consumed in large quantities.

In some cases the hopper wagon is shaped like the letter "W," and the opening doors are pivoted on the apex of the two middle inclines, so that when opened they fall with a downward swinging movement to meet each other underneath the wagon. The doors are usually operated independently by means of levers, and when closed are securely locked in position so that there is no danger of their opening at the wrong time. Stout angle stanchions are raised from each corner of the frame to provide adequate support for the ends of the vehicle. Wagons of this type are gaining popularity on railways, and recently the L.M.S.R. ordered the construction of 400 of them to be used exclusively for ore traffic.

The Hornby Hopper Wagon is one of the most interesting in the series on account of its mechanical action, and it is operated in a very ingenious manner. The body is mounted on a special base with a space through which the material falls. The angle of the two outside inclines to the base is 40 degrees and that of the inside inclines, that is the doors, is 50 degrees. This makes the two bottom points of the "W" form a right-angle. The doors are operated by a special cam rotating on a thick wire axle through the centre of the wagon sides, and this has a handle formed at one end. When the handle is pressed hard over to the right against the stop provided the cam is up and securely locks both doors; but as the handle is pulled over to the left the right-hand door begins to open under pressure of the contents of the wagon. This door is fully open when the handle has described an arc of 50 degrees, but the other door is still kept locked, although the cam has partially rotated, so that it is thus possible for one trough to be emptied at a time. The left-hand door begins to open when the handle has reached an angle of 50 degrees to the horizontal, and is fully opened when the handle is pressed hard against the second stop. Exactly the same process takes place when the doors are closed, but of course in the reverse direction.

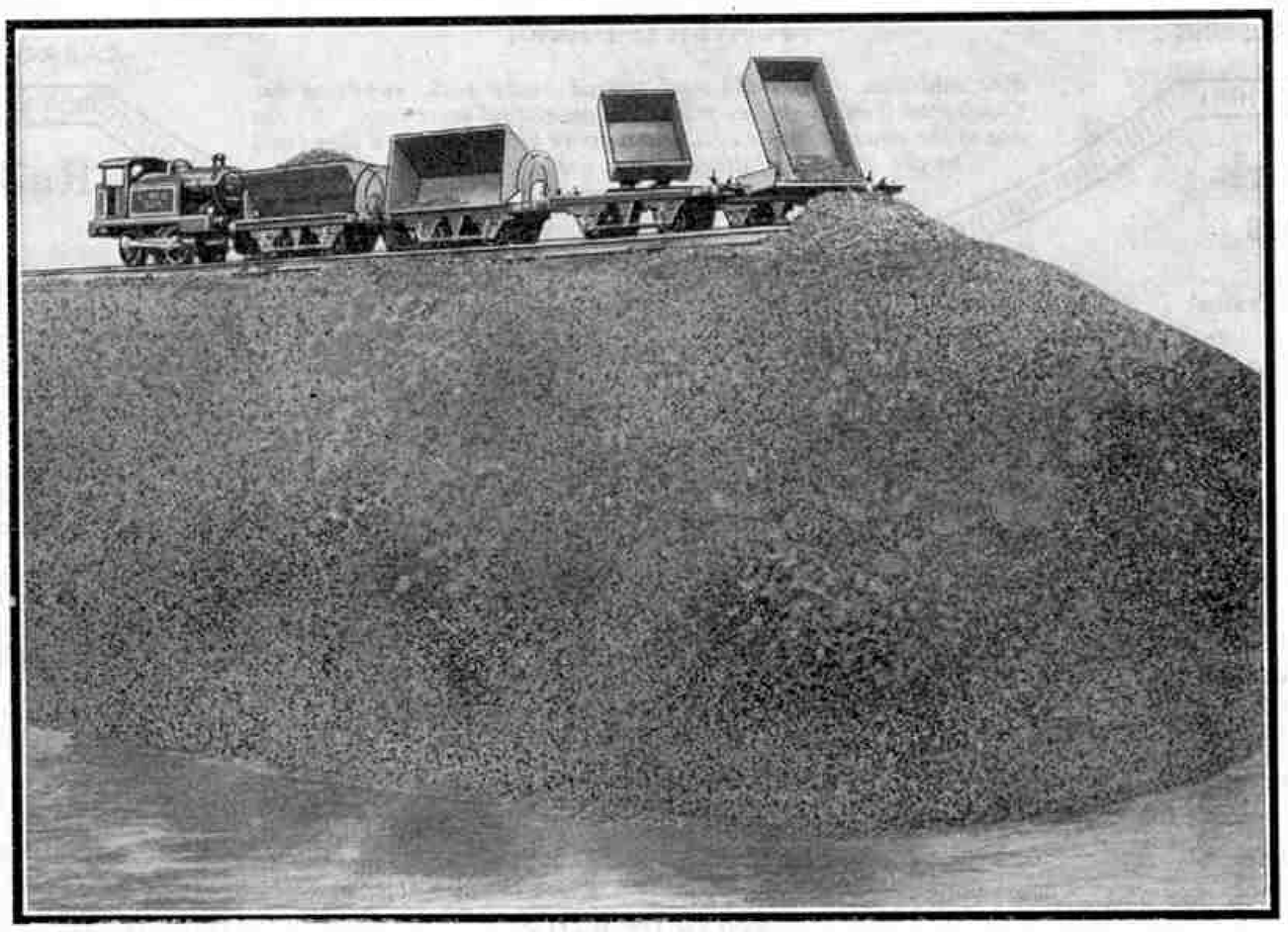
An interesting feature of the construction of this wagon is that the edges of the central space are bevelled, and the bottom edges of the doors are slightly curved, so that a perfect fit is secured, thus preventing material from finding its way out accidentally. The vehicle is finished in a dark shade of green, and is available lettered with the initials of any of the four railway groups.

The speciality of the rotary tipping wagon is the ability to discharge either over its ends or at its sides. This particular method of tipping is required when embankments on railways or by river or sea are to be constructed; and also when waste is removed from the pithead at collieries to the slag heaps. The mechanical action of this wagon differs greatly from that of other tipping wagons, and for this reason it has a special fascination of its own. It may be run as an ordinary vehicle, and then, when necessary, the body may be swivelled or tipped. In appearance the wagon rather resembles an ordinary open wagon, except for one end of the body being sloped. The body is mounted on a revolving platform and is suspended at the sloped end, so that material can be tipped either over the buffers at each end, or over the sides. Thus the wagon is able to discharge anywhere within the radius that the sloped end describes around the wagon frame.



A train of Hopper Wagons on a Hornby layout. These are loaded with locomotive coal and are being hauled by a No. 1 Special locomotive. A heavy train of empty coaches is seen on the embankment above.

The Hornby Rotary Tipping Wagon differs in every respect from the Hopper Wagon, although by carrying out its tipping in a certain manner similar results may be obtained. The wagon consists of three parts, the body, the rotating platform and the carriage. The body is $3\frac{3}{4}$ in. in length and 1 in. in height, and the sloped end projects from the floor for a horizontal length of 1 in. at an angle of 45 degrees, but does not overhang the wagon frame when in the normal position. The vertical end of the wagon has a small handle to facilitate the tipping. The vehicle is finished in orange, with the word "Meccano" transferred in gold on the sides; and it provides a splendid combination of attractive appearance and general utility.



The uses of the Hornby Side Tipping and Rotary Tipping Wagons are shown in this picture. Such wagons are largely employed by Contractors when constructing embankments or earthworks.

The third of these wagons to be considered is the side tipping wagon. Such vehicles are used extensively for tipping material to the side of the track, as, for instance, when embankments are being formed; and they are largely employed by firms of contractors. A V-shaped tub or trough constitutes the body of the wagon, and it can swing in either direction sideways. Four pivots support the body, two at each end, and these run in curved guides arranged in the end-frames. As the body is tipped the pivots furthest away from the lowered side rise up with the other side. The curved end-supports allow the pivots to travel to such an extent that the body will remain in the tipped position while the whole of the material is removed. The carriage of the wagon is merely an open framework of metal. No elaborate mechanism is necessary for tipping the body, which is done by hand.

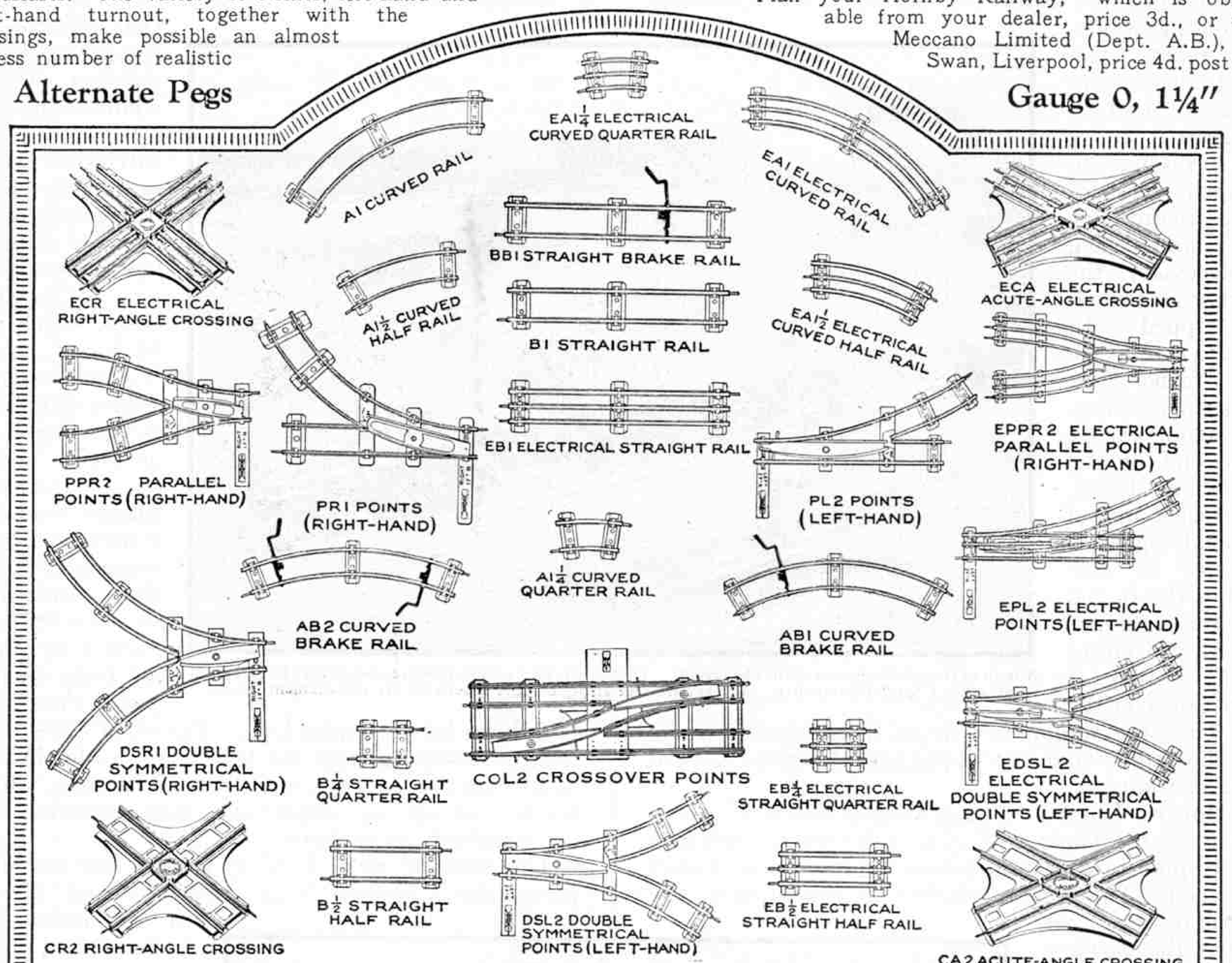
There is also to be seen a different type of this wagon having only one pivot and one bearing. This simpler scheme is generally used on wagons of smaller than standard gauge, such as those employed by contracting firms on narrow-gauge lines specially laid down for particular jobs. The other type, however, has the advantage that the body is not so liable to swing of its own accord when the wagon is running, which is a feature of special importance with vehicles running on standard gauge lines.

The Hornby Side Tipping Wagon consists of three parts, the V-shaped body, the base and the frame. In a similar manner to the actual vehicles a support at each end holds the four pivots by which the body swings, and in tipping the body describes an arc of 50 degrees, so that no material can remain inside it. When the body is pulled to one side the bottom edge overhangs the frame by $\frac{1}{4}$ in. so that the spoil is thrown clear of the wagon and does not fall on the axle ends as these are already set in $\frac{1}{4}$ in. from the frame edge. As in actual practice the wagon bears the name of a contracting firm, in this case that of the well-known light railway engineers Robert Hudson Ltd., of Leeds. The speciality of this firm is the building of rolling stock and the supplying of track for narrow-gauge systems, as used largely at quarries and collieries. The lettering is carried out in gold and red on a blue ground, and this gives the wagon a very attractive appearance.

Hornby Series -:- Rails, Points and Crossings -:- Hornby Series

Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. The variety of Points, left-hand and right-hand turnout, together with the Crossings, make possible an almost endless number of realistic and railway-like layouts. The adaptability of the Rails, Points and Crossings is well shown in a special booklet "How to Plan your Hornby Railway," which is obtainable from your dealer, price 3d., or from Meccano Limited (Dept. A.B.), Old Swan, Liverpool, price 4d. post free.

Alternate Pegs — **Gauge 0, 1¼"**



The addition of straight and curved brake rails supplied for Clockwork Trains makes possible a great deal more fun. By the use of the straight brake rail, trains may be brought to a standstill at the station platform in a very realistic manner.

Rails for Clockwork and Steam Trains

	CURVED RAILS		
	9-in. radius (For M0 Trains)		
M9	Curved rails	... per doz.	3/–
MB9	Curved brake rails ...	... each	3½d.
	1-ft. radius		
A1	Curved rails	... per doz.	4/6
A1½	Curved half rails ...	... „	3/6
A1¼	Curved quarter rails ...	... „	3/–
AB1	Curved brake rails ...	... each	6d.
	2-ft. radius		
A2	Curved rails	... per doz.	4/6
A2½	Curved half rails ...	... „	3/6
A2¼	Curved quarter rail ...	... „	3/–
AB2	Curved brake rails ...	... each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6
	DOUBLE SYMMETRICAL POINTS		
	For 1-ft. radius curves		
DSR1	Double symmetrical points, R.H. }	per	5/–
DSL1	Double symmetrical points, L.H. }	pair	
	For 2-ft. radius curves		
DSR2	Double symmetrical points, R.H. }	per	5/–
DSL2	Double symmetrical points, L.H. }	pair	
	PARALLEL POINTS		
PPR2	Parallel points, right-hand }	per pair	5/–
PPL2	Parallel points, left-hand }		
	CROSSINGS		
CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/–
CA2	Acute-angle crossings (for 2-ft. radius tracks)		1/9
CR1	Right-angle crossings (for 1-ft. radius tracks)		2/–
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9
	CROSSOVER POINTS		
COR2	Crossover points, right-hand }	per pair	12/–
COL2	Crossover points, left-hand }		
	POINTS		
	9-in. radius (For M0 Trains)		
MR9	Right-hand points ... ... }	per	3/–
ML9	Left-hand points ... ... }	pair	
	For 1-ft. radius curves		
PR1	Right-hand points }	... per pair	4/–
PL1	Left-hand points }		
	For 2-ft. radius curves		
PR2	Right-hand points }	... per pair	4/–
PL2	Left-hand points }		
PSR2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, right-hand }	per pair	8/6
PSL2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, left-hand }		
	STRAIGHT RAILS		
BM	Straight rails (for M0 Trains)...	per doz.	2/9
B1	Straight rails	„	4/–
B½	Straight half rails	„	3/–
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track ...	½ doz.	6/6
RCP	Rail connecting plates ...	„	2d.

Rails for Electric Trains

	STRAIGHT RAILS		
EB1	Straight rails	... per doz.	6/–
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/–
EDS1	Straight rails, double track ...	½ doz.	8/6
	CURVED RAILS		
	1-ft. radius		
EA1	Curved rails	... per doz.	6/6
EA1½	Curved half rails	„	4/6
EA1¼	Curved quarter rails	„	4/–
	2-ft. radius		
EA2	Curved rails	... per doz.	6/6
EA2½	Curved half rails	„	4/6
EA2¼	Curved quarter rails	„	4/–
EDC2	Curved rails, double track ...	½ doz.	9/–
	CROSSINGS		
ECA	Acute-angle crossings ...	each	4/–
ECR	Right-angle crossings	„	4/–
	POINTS		
	For 2-ft. radius curves		
EPR2	Right-hand points }	... per pair	7/6
EPL2	Left-hand points }		
EDSR2	Double symmetrical points, right-hand ... ... }	per	8/6
EDSL2	Double symmetrical points, left-hand ... ... }	pair	
EPPR2	Parallel points, right-hand }	per pair	8/6
EPPL2	Parallel points, left-hand }		
	CROSSOVER POINTS		
ECOR2	Crossover points, right-hand }	per	24/–
ECOL2	Crossover points, left-hand }	pair	
TCPL	Terminal connecting plates	each	1/6

Electrical Points for 1-ft. radius curves are not supplied

Manufactured by MECCANO LIMITED, OLD SWAN, LIVERPOOL

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

ANOTHER "IMPOSSIBLE TRAIN"

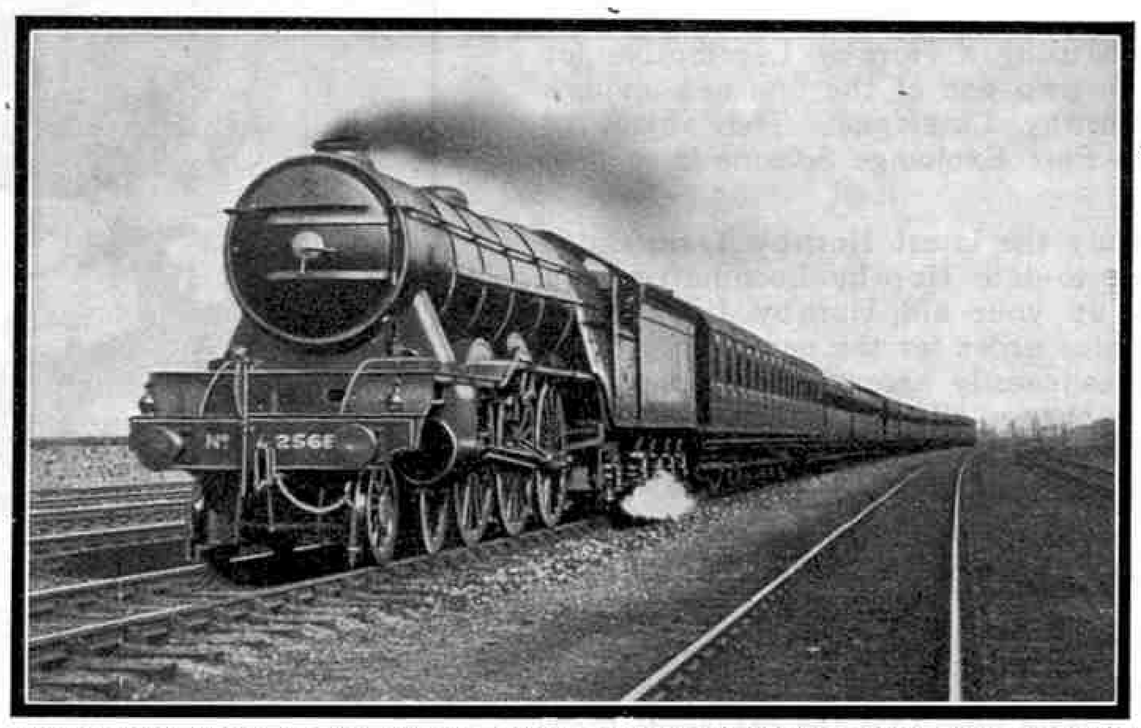
COMPETITIONS in which it is required to find mistakes made deliberately are undoubtedly among the most popular. In January 1930, we held a unique mistake-finding contest, consisting of a description of a train journey in which competitors were asked to find as many errors as possible. This attracted an unusually large entry, and therefore we announce this month another contest entitled "*An Impossible Train.*"

The idea of this contest is simple. The description of the train journey is full of more or less serious errors throughout; and the task before readers is to find as many of these mistakes as possible, and note them down on a piece of paper in the order in which they occur in the description, starting from the commencement of the journey. Here is the story:—

"On our run to Newcastle with the night coal train, we left King's Cross at 11.45 p.m. behind one of the well-known L.M.S.R. J 39's. These engines, which have the 2–6–0 wheel arrangement, are particularly well suited for this high-speed traffic, and we quickly gathered speed past the famous engine sheds. From the window of our Pullman car we had a splendid view of the coalfields for which the country east of London is so famous.

"Our journey proceeded rapidly and smoothly, and our night's sleep was only broken by the rumble and roar as we crossed the Clifton Bridge about 80 miles from London, just before the line makes its great sweep eastward past Nottingham and Crewe. At 1.45 we ran into York, punctual to the minute, in spite of a severe slack just after crossing the magnificent Selby Viaduct.

"Leaving York by the south entrance, we commenced the last stage of our run to Newcastle. On account of its severe gradients and sharp curves this part of the run has to be made at a very slow speed. We proceeded steadily, however, and as we passed through the agricultural district south of Newcastle our speed rose once more to well over 60 m.p.h. After a brief glimpse of the sea south of Redcar, with the waves gleaming in the setting sun, we entered Newcastle (Victoria), over the Swing Bridge, only five minutes late, after a most enjoyable run. Before leaving the platform we spoke to the driver, who said the "Atlantic" had behaved splendidly."



Approaching Crewe on the "North Riding Pullman," the luxurious train described in the account on this page. G.W.R. locomotive "Lord Nelson" is at the head.

The competition will be divided into Home and Overseas sections, and to the senders of the four most complete lists of mistakes in each section Hornby Railway material (or Meccano products) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded. In addition, a number of consolation prizes will be given. Envelopes containing entries should be marked H.R.C. "*Impossible Train,*" and posted to reach Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 31st July. Closing date for Overseas Section, 31st October.

Questions Contest No. 2

This month we announce a "Questions Contest" on the lines of the one that was announced on this page in the "*M.M.*" for January last and which proved so popular. This is a suitable contest for hot weather—if we get any this year!

Competitors are required to answer as many as possible of the following questions. The answers should be brief, and as a matter of fact so long as they are clear the shorter they are the better.

1. Who was the designer of the S.R. locomotive "*Lord Nelson*"? 2. What purpose does the booster serve? 3. What is the name and number of the L.M.S.R. locomotive that made the record-breaking run from Euston to Glasgow? 4. What is the working pressure of the L.N.E.R. locomotive No. 10000? 5. What is the blower? 6. What is the advantage of the superheater? 7. To whom does the Forth Bridge belong? 8. Which British railway company introduced the first "Pacific"? 9. When were Pullman Cars first used in Great Britain? 10. Where does an L.M.S.R. signalman exercise control over the "*Flying Scotsman*"? 11. What British group employs no locomotives of the "Consolidation" type?

To the senders of the four best sets of answers received in each section—Home and Overseas—Hornby Railway material (or Meccano products) to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded. In addition there will be a number of consolation prizes. Each sheet of paper used must contain the competitor's full name, address and H.R.C. membership number, omission of which will result in immediate disqualification. Envelopes should be marked H.R.C. "*Questions No. 2*" and posted to reach Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 31st July, or 31st October for the Overseas Section.

COMPETITION RESULTS

HOME

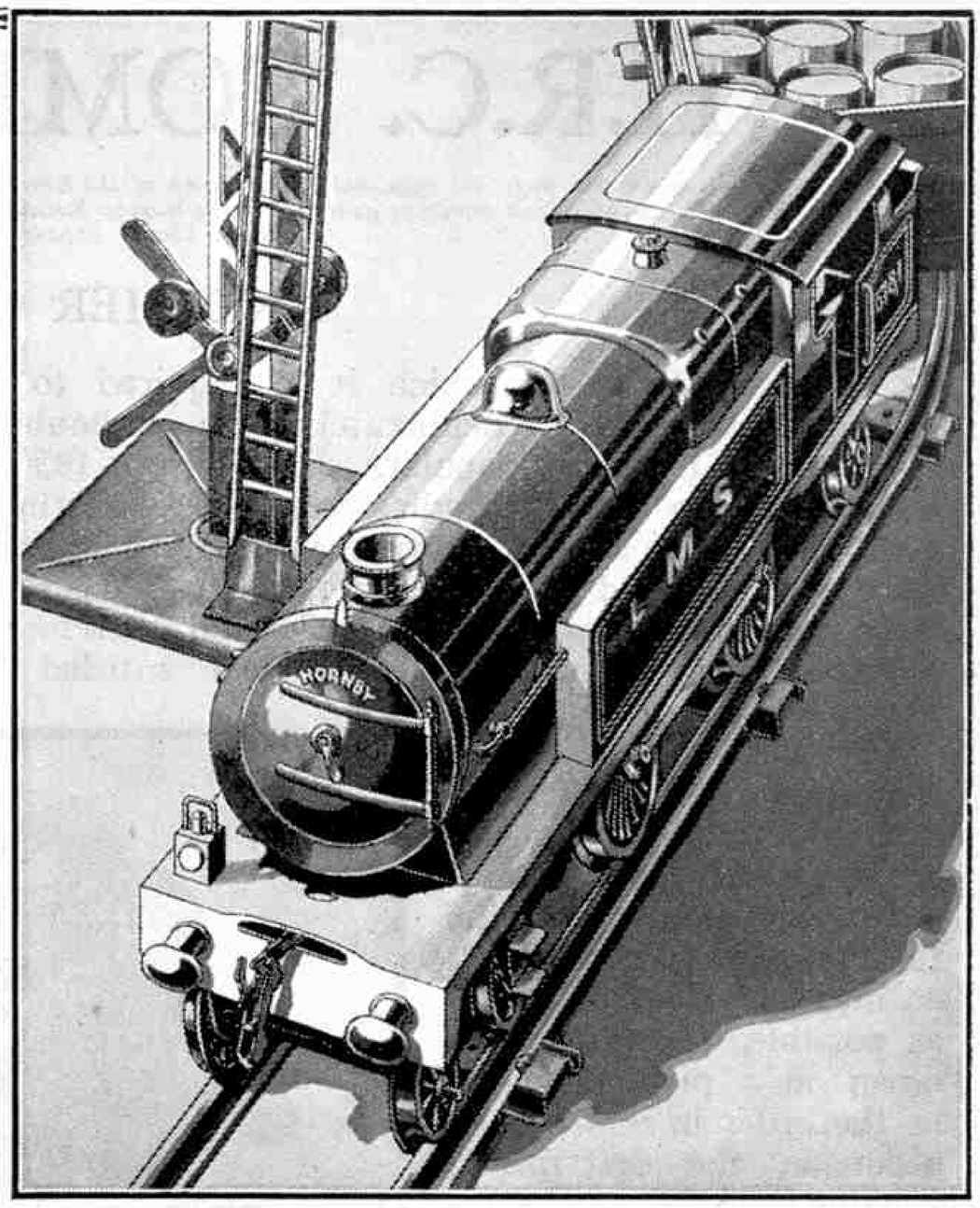
April "Rolling Stock Contest No. 1."—First: S. Winnard (7843), Ince, Wigan. Second: E. Goodcliffe (20239), Bulwell, Nottingham. Third: H. Sutcliffe (4855), Horbury Bridge, Nr. Wakefield. Fourth: D. W. Cambden (6475), Lingfield, Surrey. Consolation Prizes: D. R. Gilbert (19213), Folkestone; P. D. M. Pope (2179), East Grinstead, Sussex. O. Clarke (22800), Northampton; R. E. Wellby (6359), Highams Park, Essex; J. H. Terry (9739), Goodwick, S. Wales; R. Barbary (5580), Mevagissey, Cornwall; R. De Burgh (18226), Farnham, Surrey; R. Batten (9089), Canning Town, London, E.16; B. H. Farmer (4777), Swindon, Wilts.; G. Allan (2934), Glasgow; S. Harding (23447), Crawley, Sussex; C. W. Evans (6277), Culcheth, Nr. Warrington.

April "Station Layout" Contest.—First: W. G. L. Young (23220), East Ham, London, E.6. Second: R. Lumley (20253), Plymouth, Devon. Third: J. M. Johnston (5484), Dunstable, Beds. Fourth: R. W. Blake (345), Twickenham, Middx. Consolation Prizes: C. E. Wrayford (6039), Moretonhampstead, Devon; R. T. Johnston (10470), London, S.W.11; G. Sale (18740), Kimberley, Notts.; T. Seddon (12565), Southport; S. J. Rhodes (1187), London, E.C.1; W. Close (8898), Diss, Norfolk; D. Haddow (17845), Glasgow; H. A. T. Aitken (2602), Solihull, Warwickshire; H. R. Smith (14990), Wallington, Surrey; H. D. S. Faulder (4214), Hampstead, London, N.W.6; W. R. Lee (15735), London, S.W.11; G. B. Adams (13766), Belfast.

OVERSEAS

January "Questions" Contest.—First: V. L. M. Noguera (22773), Buenos Aires, S. America. Second: J. F. Dennison (9332), Stirling, Otago, New Zealand. Third: T. Watson (18065), N.S.W., Australia. Fourth: F. D. Aria (12362), Bombay, India. Consolation Prizes: H. W. J. Speckham (16032), Natal, S. Africa; J. Twohill (9960), Auckland, New Zealand; F. Whyte (17289), Queensland, Australia; K. N. Driver (19495), Poona, India; A. B. J. Reid (14843), Cape Town, S. Africa; A. Cramp (11438), Sydney, Australia; E. C. Stonyer (10306), South Canterbury, New Zealand; C. Humm, Geraldine, N.Z.

New Hornby Locomotives for old!



You have probably been using a Hornby Locomotive for some years and would like to own one of the fine new models that now figure in the Hornby Catalogue. The object of the new Hornby Locomotive Part Exchange Scheme is to help you to do this.

First of all, carefully study the latest Hornby Train Catalogue, and select the new up-to-date Hornby Locomotive you want; then carefully pack up your old Hornby Locomotive and post it to us, enclosing your order for the new one and the necessary remittance. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the accompanying list from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase.

If you prefer to do so, you can effect the exchange through your dealer, who will be very pleased to give you all the information you require.

The allowance that will be made for your old Locomotive is shown in the list of Part Exchange allowances for Hornby Locomotives given on this page. Please note that the catalogue price of the new Hornby Locomotive you purchase *must not be less than double the Part Exchange allowance made for your old Locomotive.*

No matter what the age or condition of your old Locomotive, you can exchange it under our "Part Exchange" plan. It is important to note that we cannot accept more than one old Locomotive in exchange for a new Locomotive.

If you decide to send your old Locomotive to us address your parcel to "Special Service Department, Meccano Limited, Old Swan, Liverpool," and be sure to enclose with it your own name and address written in plain characters.

What you have to do

Here is an example of how the plan works. Assuming you have a No. 1 Tank Locomotive that you wish to exchange, you see from the list that its exchange value is 6/3. You then look at the Hornby Train catalogue and choose one of the new Locomotives, the cost of which is not less than 12/6 (or, in other words, not less than double the Part Exchange allowance we make for your No. 1 Tank Locomotive).

You decide, say, to have a No. 2 Special Tank, the price of which is 25/–. Pack up your old No. 1 Tank and deduct 6/3 from 25/– (the price of the new No. 2 Special Tank) enclose a remittance for 18/9 plus 1/– carriage on the new Locomotive—19/9 in all. Send the Locomotive and the remittance to Meccano Limited, Liverpool.

Alternatively, you can take your old No. 1 Tank Locomotive to your dealer with a remittance for 18/9, and he will give you the new No. 2 Special Tank Locomotive that you require.

List of Part Exchange Values of Hornby Locomotives

CURRENT TYPES

M2930 Locomotive	1/–
M0 Locomotive	1/4
M1/2 Locomotive No. 3031	2/3
No. 0 Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera "Blue" Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera "Blue" Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan E Locomotive	20/-

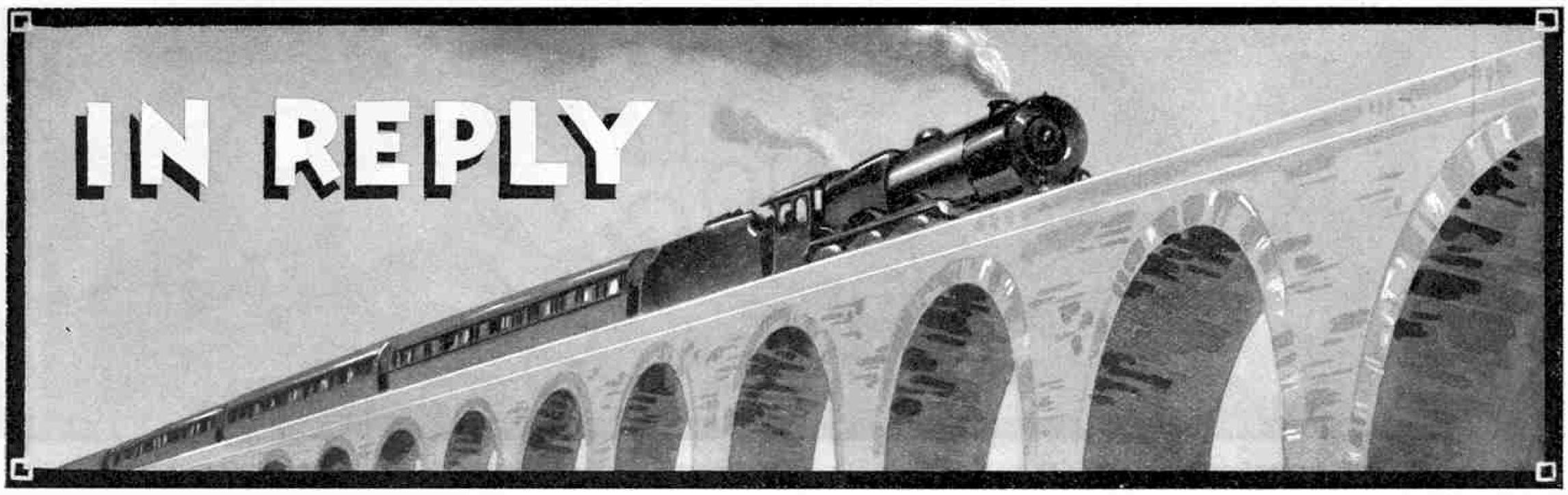
OBSOLETE TYPES

George V Locomotive, No. 00 Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan E Locomotive	20/-

HORNBY TRAINS

BRITISH AND GUARANTEED

MECCANO LTD. — SPECIAL SERVICE DEPT. — OLD SWAN — LIVERPOOL



Suggested Hornby Train Improvements

OVERHEAD WIRE EQUIPMENT FOR ELECTRIC RAILWAYS.—The transmission of current by means of overhead wires is not a satisfactory method for use on model railways. The necessary equipment is complicated, and numerous difficulties crop up in the application of the scheme commercially. The third-rail system is much to be preferred for Hornby Trains. In any case the overhead system would not be correct for the Metropolitan Locomotive, and the other Hornby electric locomotives have "steam" outlines. (*Reply to D. P. Harriott, Altrincham*).

LARGER RANGE OF OPEN WAGONS.—The open wagons at present available in the Series represent the most common types of wagon seen on British railways. It is true that 15 and 20-ton wagons are coming more into favour, and as soon as we find that they are sufficiently in demand by Hornby enthusiasts to warrant their introduction we shall consider increasing the size and capacity of our wagons. (*Reply to N. Holdsworth, Mirfield*).

No. 2 SPECIAL TANK IN METRO. COLOURS.—If this locomotive were introduced in the colours of the Metropolitan Railway it would prove useful for owners of Metropolitan Train Sets, since their line could then be made to represent the sections of the Metropolitan line operated by both steam and electric locomotives. We do not think there would be a great demand for such engines, but the suggestion will receive consideration. (*Reply to R. W. Hawthorn, Rickmansworth*).

NEUTRAL GEAR ON LOCOMOTIVES.—We are pleased to hear that you have been following the advice given in the "*M.M.*" recently with regard to the winding of locomotives. A neutral gear on our locomotives would perhaps be useful in certain circumstances, but the increased complication might adversely affect reliability and wear and tear. The majority of Hornby Train owners probably prefer the present arrangement. (*Reply to G. R. Johnston, Coalville*).

WAGON RETARDERS.—Wagon retarders similar to those in use at Whitemoor Marshalling Yard would no doubt be effective and realistic for use in a model "hump" yard. We are afraid, however, that they would be too costly to produce. (*Reply to P. Hughes, Wisbech*).

DINING AND KITCHEN CARS.—These no doubt would prove useful on long-distance expresses, and would give a realistic appearance to this class of train. They will be considered in connection with the development of our main line passenger rolling stock. Why not use the L.M.S.R. No. 2 Saloon Coach? (*Reply to J. L. Taylor, Rochdale*).

LARGER GOODS PLATFORMS.—A larger goods platform would take up an undue amount of space, and the present platform is of ample size for the needs of most model railways. If you desire to increase the size of your goods platform we suggest that you add to it sections of passenger platform, and place platform cranes at intervals. Alternatively you might join two platforms together, and in this manner obtain a representation of a large depot. (*Reply to E. M. Walsh, Southampton*).

WHITE DIAMONDS ON SIGNAL POSTS.—The addition of diamond-shaped plates to our signal posts would no doubt make them more realistic, but every detail of this kind adds to the cost. They can easily be made of thin card or metal and attached to any post as required. (*Reply to F. R. Bartlett, Thirsk*).

ACCUMULATOR BOXES ON METROPOLITAN COACHES.—We agree that the addition of accumulator boxes carried underneath our Metropolitan coaches would enhance their realistic appearance, and we are therefore filing your suggestion for consideration. (*Reply to T. Machin, Waterford*).

ADJUSTABLE LOADING GAUGE.—We doubt if there would be much call for a loading gauge of this pattern on a model railway, as all Hornby vehicles conform to fixed standards and comply with the existing gauge. (*Reply to R. Hope, Sheffield*).

L.M.S.R. No. 2 SPECIAL TANK.—The Hornby No. 2 Special Tank Locomotive does not resemble the new 2–6–2 tanks now in service on the L.M.S.R. either in appearance or in wheel arrangement, and therefore we cannot consider renumbering it as you suggest. (*Reply to B. W. Watson, St. Albans*).

CHAIN AND HOOK COUPLINGS.—These are not effective on a model railway laid with rails of 2 ft. radius, as buffer locking would result. Even if special buffers were fitted, difficulty would be experienced with bogie vehicles. We regret, therefore, that further consideration cannot be given to the idea. (*Reply to H. Chambers, Thanet*).

INSPECTION COACH.—Although these vehicles are necessary in real practice, a miniature reproduction would be of little practical value. Could you not use an old coach suitably renovated, or perhaps a Hornby No. 1 Pullman Coach, for this purpose? (*Reply to E. Hope, Euxton*).

LOCOMOTIVES IN PRE-GROUP COLOURS.—We do not think that locomotives in pre-group colours would prove very popular, as all locomotives are now running in the colours of the four groups. Another point is that some of the Hornby locomotives represent classes that have only been introduced since grouping took effect. (*Reply to G. Wilson, Dorking*).

CONICAL BOILERS FOR G.W.R. SPECIAL TANKS.—The fitting of conical boilers to these locomotives would make them thoroughly representative of G.W.R practice, and no doubt give them a more true-to-type appearance. Boilers of this pattern are rather expensive to manufacture, however. Belpaire fire-boxes would be necessary also, and it would be difficult to find room for these on a No. 1 Special Tank Locomotive. (*Reply to H. F. Fitzmorris, Plymouth*).

BELPAIRE FIRE-BOX ON "SHIRE" LOCOMOTIVE.—The fact that three of the No. 2 Special locomotives are fitted with Belpaire fire-boxes no doubt prompted you to send this suggestion. As the actual "Shire" locomotives are fitted with a round-top fire-box, we are afraid that we cannot introduce the Belpaire pattern on our model. (*Reply to R. Callander, Berwick*).

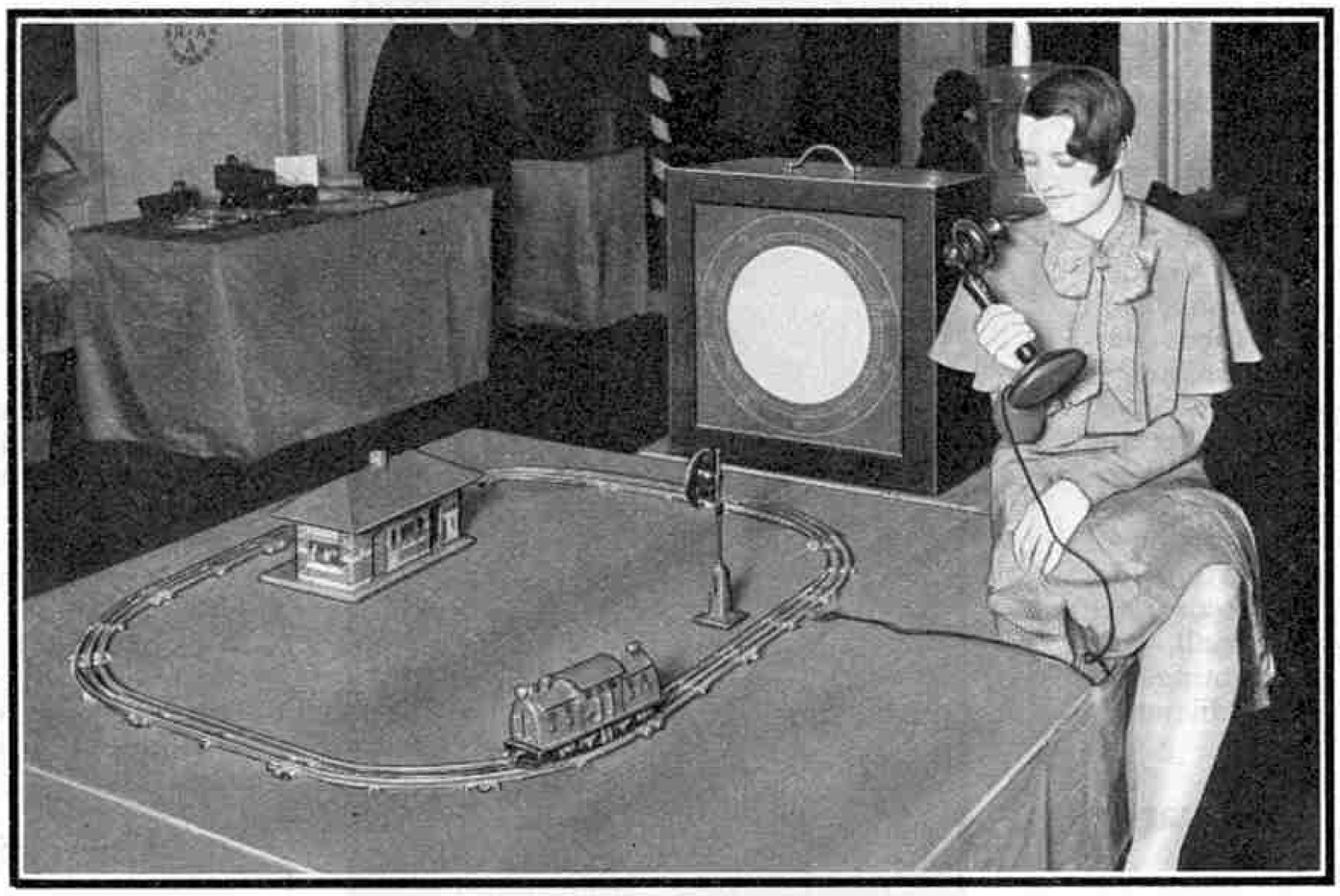
HYDRAULIC BUFFER STOPS PAINTED DARK RED.—The Hydraulic Buffer Stops would no doubt look rather more realistic if they were painted this colour, as is often the case in actual practice. This suggestion will therefore be considered. (*Reply to R. V. Hulse, Harwich*).

MODEL CARRIAGE SHED.—The size of a carriage shed depends upon the amount of passenger rolling stock in use on a model railway, and to be satisfactory it would have to be made to suit the requirements of the layout. We therefore suggest that you model these at home from cardboard. We hope shortly to deal in the H.R.C. pages with the layout and installation of carriage sidings and sheds. (*Reply to H. W. Morris, Swindon*).

No. 1 SPECIAL LOCOMOTIVE WITH INSIDE CYLINDERS.—We were interested in your suggestion that the omission of the outside cylinders from the No. 1 Special Locomotives in goods colours would enable these engines to represent more or less the usual British goods engines. The Passenger No. 1 Special might then be considered to represent the outside cylinder "Moguls" that are used so extensively to-day. (*Reply to T. Bailey, Ambergate*).

S.R. LUGGAGE VAN.—These vans are interesting vehicles, but they are practically peculiar to S.R. practice, and therefore miniature reproductions would only be acceptable to S.R. enthusiasts. We suggest that you should use the No. 2 Luggage Van in S.R. colours. Possibly the introduction of containers will fulfil the same purpose as the luggage trucks with detachable bodies used on the Continental expresses. (*Reply to R. Sheppard, London, S.W.11*).

COVERED-IN STATION.—A covered-in station of the pattern you suggest would be very costly to produce in a satisfactory model. Buildings of this nature are best made at home to suit the operator's own requirements (*Reply to R. Leighton, Cork*).



A miniature electric locomotive that obeys spoken orders given through an ordinary telephone transmitter! The voice impulses are carried through a radio detector valve to a selector that determines the polarity in the track, upon which the movement of the engine depends. Three or more syllables give forward movement; a two-syllable order sends the engine backward, and a single syllable stops it. This photograph is reproduced by courtesy of the General Electric Company of America.

How Club Spirit may be Developed

We have now reached the period of the year when days are longest and, even in our much abused climate, for the next few weeks we may expect to be able to spend most of our leisure hours in the open air. Reports from clubs show that preparations have been made for continuing work on suitable lines, for in practically all cases a programme of games, visits and excursions has been substituted for indoor meetings. The plans of most clubs are admirably varied and include many attractive items, and I hope that members are taking full advantage of the opportunities for obtaining healthy recreation that are provided for them.

During the next two months there may be a little more time than usual in which Leaders and other officials may think quietly over new schemes. One of the chief aims in conducting a Meccano club should be to encourage each member to work "for the team" instead of for his own hand, and it is chiefly for this reason that the members of many clubs are divided into sections that are pitted against each other in Model-building and other competitions, of course. In certain instances work is planned on co-operative lines, however. This may be equally effective in developing club spirit, and the advantages of promoting joint efforts should not be overlooked. When the construction of a large club model, or the preparation of a special display, is carried out in accordance with a sound plan agreed upon by all, each member will be keen on performing the share of the task allotted to him efficiently in order not to let his club down.

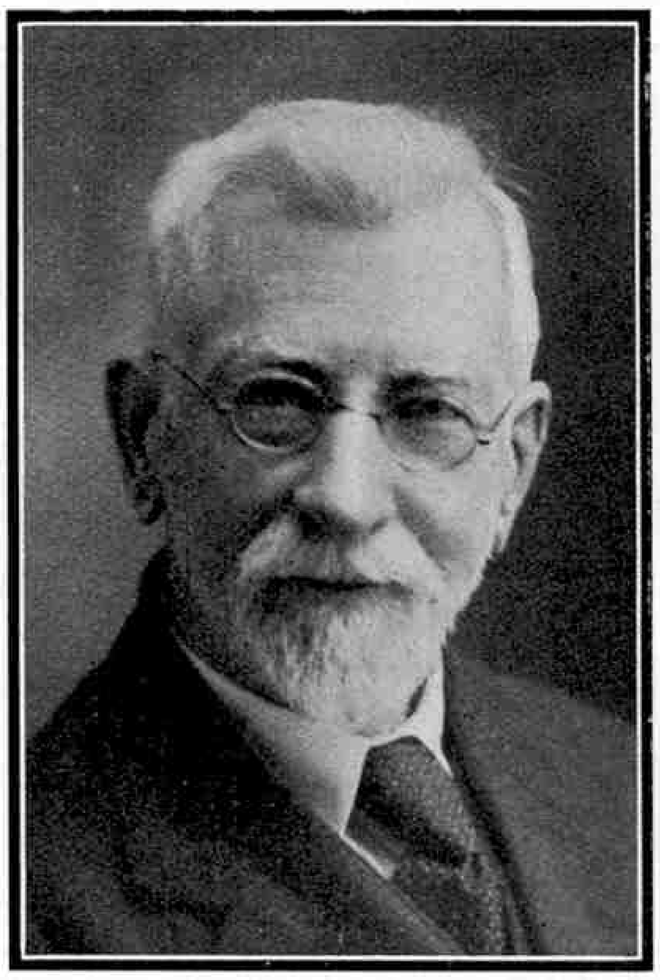
A Splendid Model Dockyard

An interesting example of successful co-operative effort of this kind is shown in the illustration on the opposite page. This represents the exhibit of the Sketty M.C. at a Maritime Fair held in Swansea. The scene is a model dockyard complete with grain elevator and ship coaling plant. Electric trains carry goods to and from the dock, in which may be seen ships of various kinds, including a liner, a destroyer and a hospital ship. Many of the visitors to the Fair were familiar with ships and dockyards, for the proceeds were in aid of a fund for the benefit of seamen, and the admiration they expressed was a splendid testimony to the correctness and general excellence of the display.

The whole of the model-building involved in the ambitious scheme of the Sketty M.C. was the work of the members themselves, who were also jointly responsible for the design of the display. The success of the plan undoubtedly has helped to strengthen the feeling of solidarity in the Sketty M.C. Similar work also has been done in other Meccano clubs, and I hope that Leaders and officials of those in which co-operative model-building has not yet been introduced will consider the advisability of working on similar lines during next winter. Following out such a scheme has the advantage that preparations for an Exhibition are easily carried out, and it will be found that visitors are more impressed by an exhibit of this kind than by an array of separate models.

Meccano Club Leaders

No. 52. Mr. W. Stone



Mr. W. Stone is Leader of St. John's Church (Weymouth) M.C. which was affiliated in November 1930. Members are very enthusiastic and under Mr. Stone's inspiring leadership have taken part in a series of very keenly contested Model-building Competitions. A splendidly varied programme is followed, and a special feature is made of the club's Library.

New Award for Enthusiastic Members

Very often Leaders inform me that they wish to recognise further good work by members who have already been awarded Merit Medallions. In order to enable them to do so in a suitable manner I have decided to introduce a new award. This will take the form of a Bar to be worn with the Merit Medallion in order to indicate long continued efforts to further the interests of the club to which the recipient belongs, and of the Meccano Guild generally.

The design of the new award is a matter that needs careful thought. The colours of the ribbon to be used in connection with it must be those of the Guild, of course, and designing the Bar itself also will present little difficulty. Finding a suitable inscription may be more troublesome. This should consist of one or two short Latin or English words indicating that the Bar is supplementary to the Medallion, which is presented "for service to the Meccano Guild." In this connection Leaders and others interested in club work may be able to offer interesting suggestions, and I shall welcome co-operation in deciding upon words that express the desired idea as concisely and neatly as possible.

I hope to make the first awards of the Bar at the end of the year. One Bar will be allotted to each club at the close of each of the four sessions, and the practice already in force in regard to Merit Medallions will be followed, Leaders being asked to nominate the members they think have deserved the award. I am sure that there will be keen competition for the Bar and those who become entitled to wear the new distinction will be extremely proud of the honour they have earned.

Correspondents Wanted

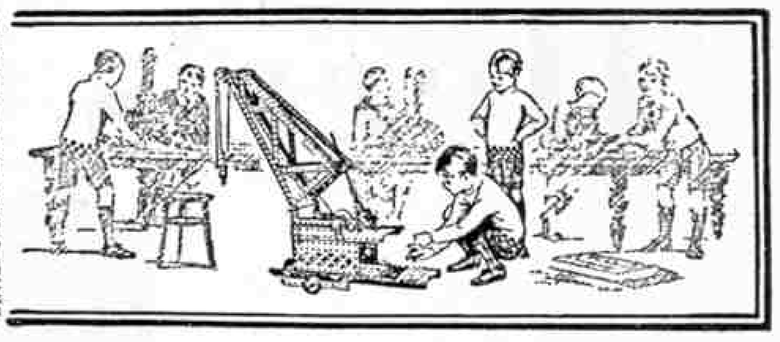
The Correspondence Club continues to grow in a very satisfactory manner and increased interest in the opportunities it provides is being shown by members of the Guild in all parts of the world. For the benefit of newcomers I may point out that membership is open to all members of the Guild, and care is taken to bring together correspondents of similar tastes, who find great pleasure in the discussion of problems connected with the hobbies and other interests they have in common. Forms of application may be obtained from Headquarters, and as soon as each applicant returns his form duly filled in I endeavour to find a suitable correspondent for him.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places and boys interested should communicate with the promoters whose names and addresses are given below :—

CEYLON—Mr. C. P. P. Samarasekera, Malamulla, Panadura.
COVENTRY—D. Parry, Courtrai, 292, Binley Road.
DAGENHAM—S. A. Pashley, 84, Holgate Road.
EXMOUTH—A. Nunn, 39, Waverly Road.
READING—S. Hine, 3, Bridge Street.
WHITESTAKE—Mr. A. E. Riding, "Myrtle Dene," Coote Lane.

CLUB NOTES



Tynecastle School (Edinburgh) M.C.—Wireless Set construction now ranks second to Model-building. A special Debate was arranged on "*Electricity v. Steam.*" The subject greatly interested members, and after a keen struggle the majority voted in favour of steam for all-round power purposes. Club roll: 50. *Secretary*: Wm. Urquhart, West Bank, West Mill Road, Colinton, Edinburgh.

St. Feock School M.C.—Last session ended with a very successful Exhibition, when visitors expressed their appreciation of the splendid models and Hornby Train Layout on view. A short humorous play entitled "*Catching a Lunatic*" was a popular part of the proceedings. Members are now enjoying a special outdoor programme consisting largely of rambles on the seashore. On one of these two smugglers' caves were visited. Leatherwork Evenings have been introduced, members making bookmarks and similar articles. Club roll: 11. *Secretary*: John Rogers, West Trevilla, St. Feock, Truro.

St. Columba's (Southwick) M.C.—Recent Model-building Evenings have been devoted to the construction of models suitable for use in connection with coal mines and railways On one Contractors' Night tenders for a crane to be used for quayside work were called for and great ingenuity was shown in fulfilling the conditions. Competitions for models showing inventiveness have also been held, and the proceedings have been varied by Table Tennis and Draughts Tournaments. A special Display was arranged on the occasion of a visit by members of the New Silksworth M.C. Club roll: 32. *Secretary*: R. Tutin, 11, Gordon Terrace, Southwick, Sunderland.

Pharos County School (Dover) M.C.—A visit was paid to the Motor Engineering Works of Messrs. Martin Walter Ltd., Folkestone, and this was followed by a Lecture on "*The Principles of the Motor Car.*" The members were then asked to build models to illustrate the visit. This led to excellent work, a model of a Motor Fire Engine being particularly realistic. Films are freely used at meetings, those recently shown including "*The Land of the Shah,*" which dealt with petroleum production in Persia, and "*A Tour of the Welsh Highlands in a 30-cwt. Ford Truck,*" the films being kindly loaned by Shell Mex Ltd., and the Ford Motor Co. Ltd. Summer activities are being restricted to visits, officials and members being engaged in preparations for transference to new school buildings. Club roll: 30. *Secretary*: G. L. J. Bailey, 40, Heathfield Avenue, Dover, Kent.

St. George's (Edinburgh) M.C.—An intensive programme of Model-building Competitions has been followed. This included a Commercial Motor Show, among the models entered in it being an Articulated Lorry with eight wheels, Removal Van and Trailer, and a Motor Cattle Truck, in addition to Tractors and ordinary Lorries. The summer programme includes visits to the "*Scotsman*" Printing Works, the St. Margaret's Locomotive Sheds of the L.N.E.R., and Granton Gas Works. Club roll: 76. *Secretary*: J. A. Gower, "Fairhaven," Russell Place, Trinity.

Hendon M.C.—Special features have been the building of Meccano models of Motor Cars and of model Aeroplanes. The cars were employed in a series of races and a hill-climbing contest also was arranged. Few of the aeroplane models flew in a sufficiently straight line to enable similar contests to be held, but efforts are being made to overcome this difficulty. Mr. A. L. Owen has been obliged to resign the Leadership owing to removal, but Mr. F. S. Bardell kindly undertook to fill the position. Cycle Runs and Outdoor Games are included in the summer programme. Club roll: 13. *Secretary*: P. H. Davies, 67, Sevington Road, Hendon, N.W.4.

St. Peters (Southwark) M.C.—The grant of affiliation has increased the enthusiasm of members, and at almost every meeting new ideas are introduced. Model-building is the chief activity and a system of awarding marks in competition for session prizes has been introduced. Hornby Train Nights have been arranged and experiments on running to timetable have been made. Club roll: 7. *Secretary*: S. Leach, 77, Union Street, Southwark, S.E.1.

South Park Central School (Ilford) M.C.—The last meetings of the Spring session were devoted to Model-building, Hornby Train Evenings, and Debates; Wireless Sets and Cabinets also were made. A Social Evening concluded the meetings. The school is shortly removing to new premises and an extension of the club's activities is then looked for. Club roll: 31. *Secretary*: R. Merchant, 37, Montreal Road, Ilford, Essex.

A splendid Model Dockyard constructed by members of the Sketty M.C. for exhibition at a Maritime Fair. On the left is a Grain Elevator and near it may be seen a Coaling Plant that delivers real anthracite into the bunkers of the ships in dock. Frequent electric trains on the Hornby Railway bring goods for shipment and carry away those landed from incoming vessels.

Middlesbrough M.C.—This excellently organised club continues to make splendid headway, Model-building Competitions, Debates, Talks, and Hornby Train Nights being the chief items of the programme. On "Paper Night" eleven papers of very high standard were read by members, the prize-winner being S. Tapster, who read a paper entitled "*The Road of Records.*" On one evening a special programme of short humorous stories, games and jokes was carried out. A Mock Trial also has been held, but owing to trouble given by the officials sentence could not be passed. The Annual Parents' Evening attracted a large attendance in spite of bad weather. "Ghost Night" is now an annual event. An enquiry was held into the appearance of a ghost on the very night set apart for this! The witnesses gave vivid accounts of what happened, and eventually it was found that the Assistant Leader was the culprit. Club roll: 90. *Secretary*: R. Rowlatt, 3, Blenheim Villas, Longlands Road, Middlesbrough.

The Leas (Hoylake) M.C.—Cranes and other models constructed by members at home have been demonstrated at club meetings. Interesting talks of a practical engineering character have been given by Mr. J. F. G. Bigland, Leader of the club, and others, the topics including "*When Wheels Revolve the Wrong Way,*" "*Watches and How They Work,*" and "*Shape and Strength,*" the third of these dealing with the use of Girders, Trusses, etc. Excellent use is made of newspaper illustrations, a collection of those of engineering interest having been made by the Leader. Outdoor pursuits are not forgotten and a talk by two of the members on "*Stream Fishing*" proved very interesting. Club roll: 38. *Secretary*: F. L. Ashcroft, The Leas, Hoylake.

Sutton Bridge M.C.—A special study was made of the Meccano Motor Chassis on loan from Headquarters, this being used to illustrate "*The Story of the Motor Car.*" Excellent models have been made by members of the Senior and Junior Sections. The Seniors constructed a large Warehouse and the Juniors built models of Aeroplanes. Regular Hornby Train Nights are to be introduced. Club roll: 6. *Secretary*: F. E. Scales, 18, Wharf Street, Sutton Bridge.

Wimbledon M.C.—In spite of rain the Exhibition attracted a large number of visitors. The display included a Meccano Loom, a Cotton-covering Machine, a Funicular Railway, and other large models in addition to a Hornby Train Layout. A Cinematograph Show provided interesting entertainment and the total proceeds amounted to £3. The success of the Exhibition was due to excellent organisation, a special business meeting having been held to make the necessary arrangements. An outdoor programme of Cycle Runs and Games is now being followed. Club roll: 16. *Secretary*: G. W. Rose, 117, Dora Road, Wimbledon Park, S.W.19.

Hyde Chapel M.C.—Motor Cars and Motor Cycles have been the chief subjects of recent Model-building activities. Mr. W. L. King, Leader of the club, gave a talk on the two-stroke petrol engine, and this was followed by a members' discussion of the four-stroke engine. The programme has also included regular discussions on topics of special interest. A camping holiday in Derbyshire was held recently. Club Roll: 16. *Secretary:* A. Oldham, 353, Stockport Road, Hyde.

AUSTRALIA

Hobart (Tasmania) M.C.—The Annual Exhibition, Fair and Entertainment was opened by the Mayor of Hobart, who presented Merit Medallions and prizes won in Competitions. There was a large attendance and the sum of £8-10s. was realised. Members are keenly interested in Model-building Contests, and recently prizes were awarded by a local dealer for models built by members, entries being displayed in his windows. A visit was paid to the Hobart Junior Technical College, where practical class work was inspected. Games Nights are frequently held, Rifle Range Shooting being one of the chief recreations. Club roll: 21. *Secretary:* J. D. Hurburgh, 69, Cross Street, New Town, Hobart.

INDIA

George Town (Madras) M.C.—A series of meetings were devoted to electrical engineering topics, the Professor of Electrical Engineering in a Madras College kindly giving talks to members. Competitions of various kinds have been held, some of which were arranged in order to encourage members to give talks and demonstrations. A two days' camp has been held, and an Exhibition and Variety Entertainment was arranged in order to strengthen club funds. Club roll: 30. *Secretary*: P. Jambulingam, 12, Pauliappan Street, George Town, Madras.

SOUTH AFRICA

Malvern Wesleyan M.C.—The programme continues to arouse great interest and includes Model-building Competitions, Lectures, Debates, Papers by members, Visits and Picnics. A Meccano Club Sports Meeting has been held, the clubs taking part being Malvern Wesleyan, Clifton, Turffontein and Germiston. The various events were keenly contested. Great amusement was caused by a "Meccano Race," in which girl members carrying four 12½ in. Perforated Strips ran to a point where an equal number of boys held Nuts and Bolts in readiness to make a frame. When complete these were slipped over the heads of the boys, who then ran 100 yds. to complete the race. A second joint meeting with the Turffontein M.C. was held at the Malvern M.C. club room, when Mr. and Mrs. E. Harris were present. Mrs. Harris presented the prizes to winners at the joint sports, and Mr. Harris presented a silver cup to the Turffontein M.C., who had won the club prize. This trophy was given by Mr. Harris himself, and will be competed for annually by the clubs of Johannesburg and district. Club roll: 44. *Leader*: Mr. E. Sykes, P.O. Box 8, Cleveland.

Here's *your* camera—

Officially approved by the Boy Scouts' Association

the Boy Scout KODAK

This is the camera that will take the photographs you want to take—the Boy Scout Kodak. It has four stops—landscapes, interiors and portraits can all be taken by either time or instantaneous exposures. A keen camera—made specially to help you in your try for a Photographer's Badge or a prize in the great Kodak Competition.★ A smart camera—made in dark green with a special case that slings on your belt. Bearing the Boy Scout emblem as a sign that it has been officially approved by the Boy Scouts' Association. "Be prepared"—with a Boy Scout Kodak.

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'KODATONE' *is the Kodak daylight printing paper. No guesswork with 'Kodatone'! It is self-toning and only requires fixing in plain hypo to give beautiful sepia prints. To obtain a rich purple tone just soak your print for five minutes in a solution of common salt and water before fixing in the hypo bath.*

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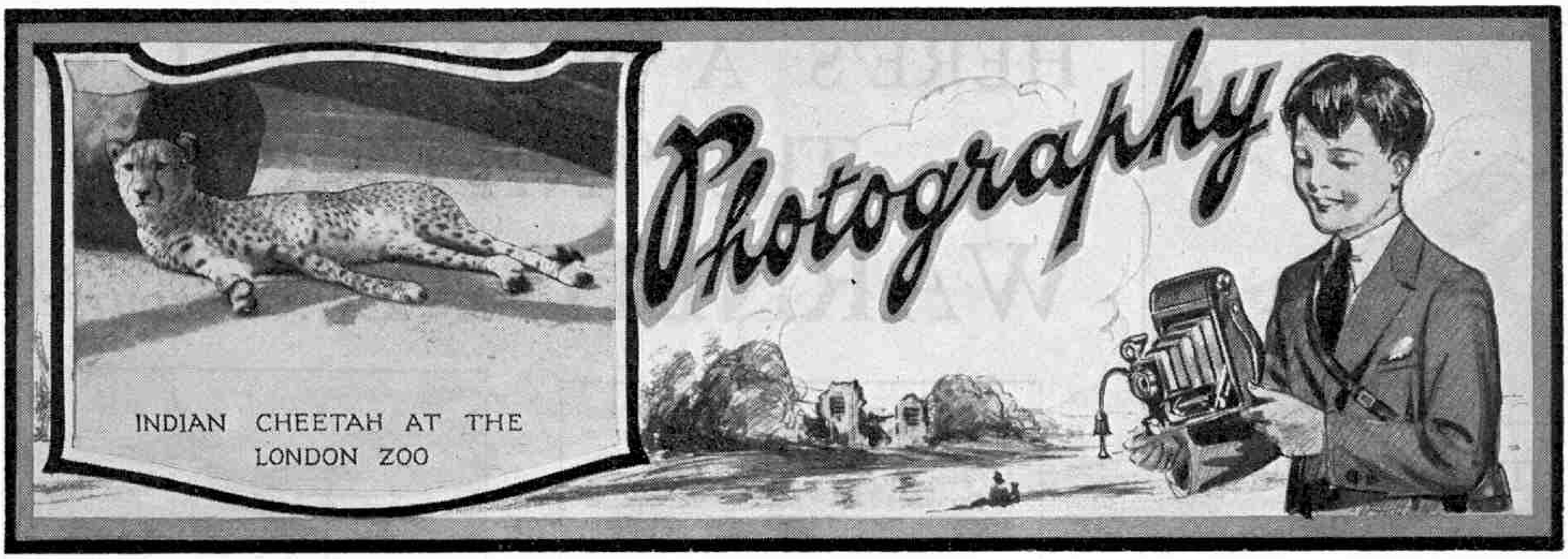
IF IT'S PHOTOGRAPHY—IT'S KODAK



HOLIDAYS AND THE CAMERA

AT this time of the year cameras of all kinds, new and old, make their appearance in surprising numbers. It is almost certain that more photographs are taken during July, August and September than in the remaining nine months of the year put together. This is the great holiday period, and no holiday is really complete without a camera. The range of possibilities within reach of even a novice with the cheapest form of camera is almost unlimited. The owner of a camera is able to bring home at the end of a holiday a record that is not only permanent, but actually grows in interest as time goes on. Without such a photographic record the memories of even the most enjoyable and interesting holiday become dimmer and dimmer, and finally fade away.

Those who possess cameras that have been laid by for some time should make sure that these are in good working order before they take them away on a holiday. Nothing is more irritating and disappointing to the amateur than to take a series of holiday snapshots and then find, when it is too late, that they are all spoiled because the camera was not light-tight, or the shutter was not working properly. The best plan is to expose a film and have it developed and printed. Then any defect in the camera is easily seen, and can be quickly remedied.

Cameras and photographic materials of all kinds are now so reliable and simple to use that no one should have any difficulty in securing a good series of holiday records. The failures that occur are almost always due to attempting impossibilities. The most important point to remember is that successful snapshots require a reasonably good light. It is little use to attempt them late in the evening, or during the day when the sky is overcast with dark clouds. The best advice that can be given to a beginner is to spend 1/6d. on the "Wellcome" Photographic Handbook. This contains an exposure calculator that makes it the simplest possible matter to ascertain quickly whether the conditions at any moment are suitable for snapshots. In addition to the calculator the handbook is full of useful and interesting advice on almost every branch of photography, both indoors and outdoors.

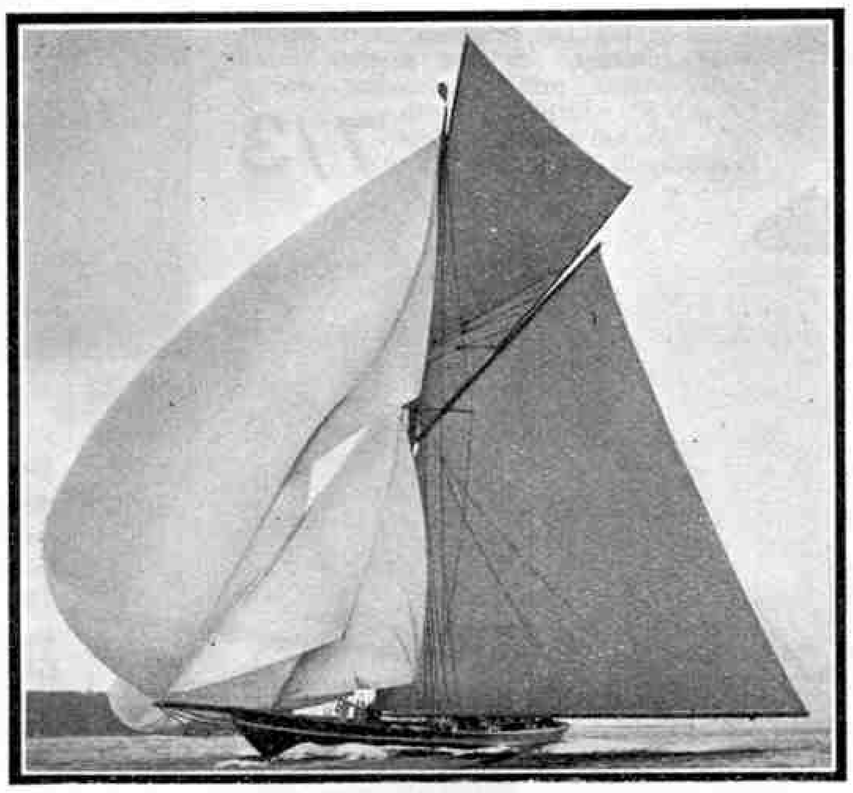
Another thing that the beginner in photography must always bear in mind is that close-up photographs of rapidly moving objects cannot be taken with the average cheap camera. The fastest shutter speed of such a camera is generally about 1/25 or 1/30 of a second, and this is far too slow for any rapid movement at close quarters. Fairly good snapshots of objects moving at only a moderate speed may be secured with such shutters if the photographer stands well away from the object. Of course the resulting pictures will be very small, but they should be sufficiently sharp to allow of considerable enlargement.

A fine photograph of a dog family. This illustrates how it is possible, by careful arrangement of lighting, to suggest the actual texture of the animals' coats. For this photograph and the one below we are indebted to the courtesy of Ilford Ltd.

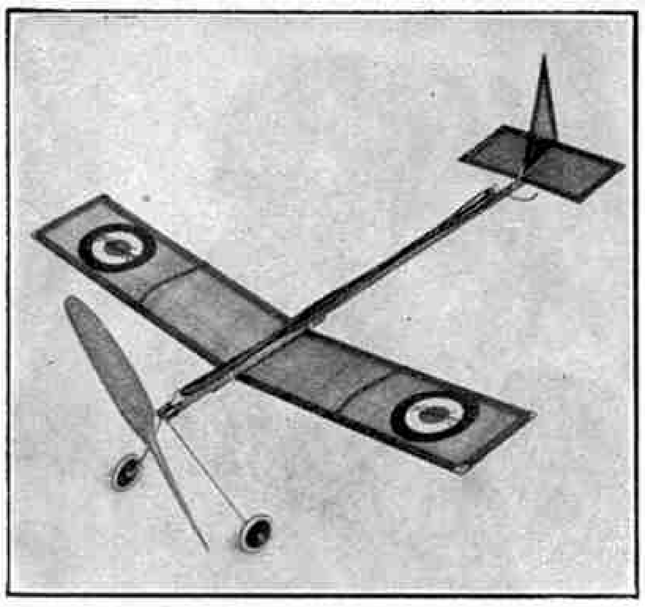
Many cheap cameras are of what is known as the "fixed focus" type; that is to say they are not provided with any means of focussing objects at different distances. Such cameras are perfectly successful for general views of any kind, but they cannot be used for near subjects such as head-and-shoulder portraits. This difficulty is overcome by placing in front of the lens what is known as a "portrait attachment," which automatically brings into sharp focus objects that are only three or four feet away from the camera. Such attachments, which consist of a lens mounted so that it can be slipped over the regular lens, may be obtained cheaply for most small cameras.

The majority of cheap cameras are provided with a "view finder" to show the extent of the picture that will appear on the film. This finder usually consists of a tiny lens that throws on to a mirror a miniature reproduction of the view. This type of finder is not absolutely accurate, and if a certain object that it is desired to include in the photograph is seen to come close up to the edge of the finder image, it is not safe to assume that this will appear as it is wanted on the film. In such a case it is best to move slightly further away, so as to bring the object more into the centre of the finder image and thus allow for a margin of error. The camera should be held so that the eye looks directly down on to the finder mirror.

In making the exposure the camera must be held quite steady. To the average person it is practically impossible to do this for more than about 1/15 of a second; and if a longer exposure is necessary the camera must be placed on a tripod, or on a convenient wall, fence or other solid support. Another important point is to press the shutter release gently and steadily in order to avoid jerking the camera at the moment of exposure.



Yachting scenes provide splendid material for snapshots.



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The "NIPPER"
WARNEFORD of course!

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Price 2/6

Special Features:

A long bearing allowing no movement or wobble on the propeller—therefore a steady flyer. High tension steel wire tail and rudder—therefore model can be adjusted for stunting. All aluminium wheels, fitted brass bearings, and the model has an amazing performance as the whole Aeroplane weighs less than one ounce. The finest machine ever produced at such a price.

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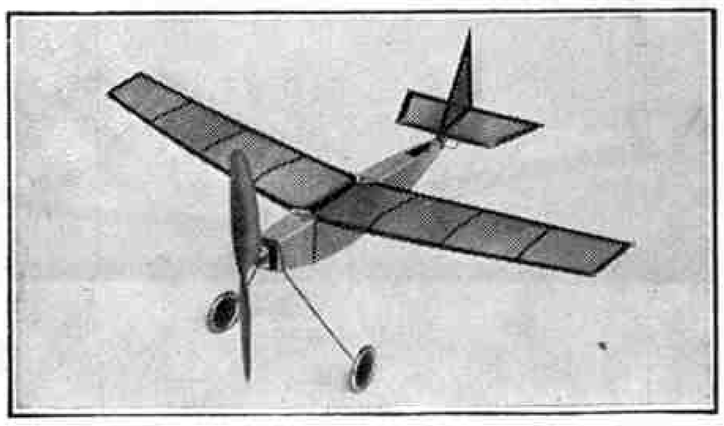

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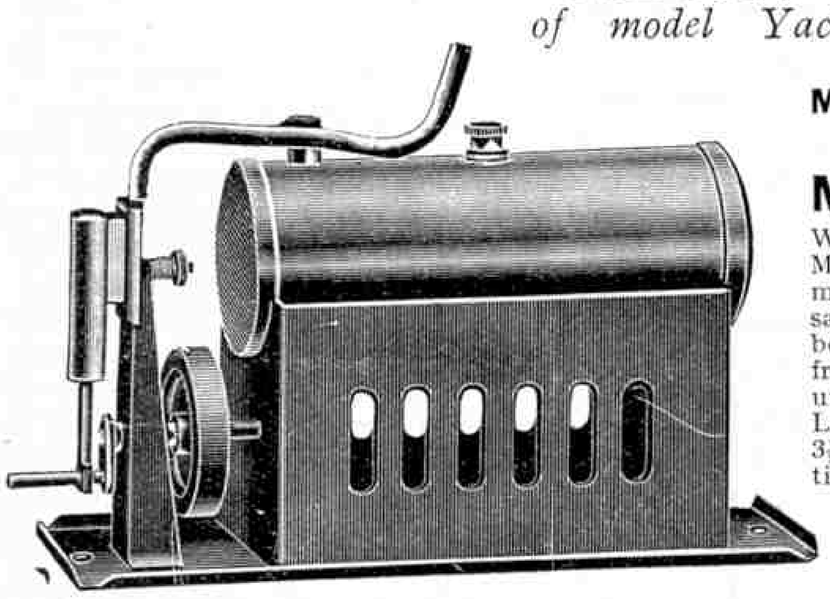

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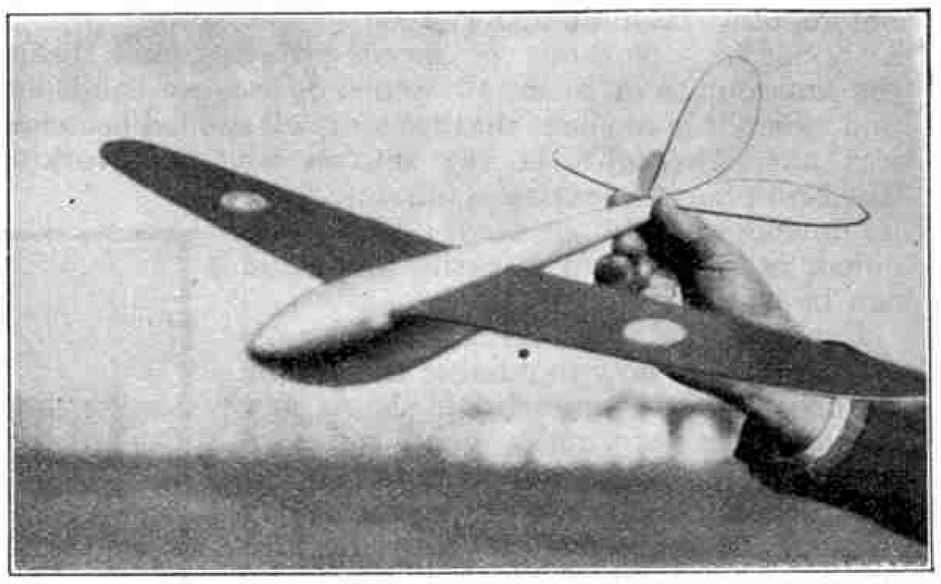

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Competition Page

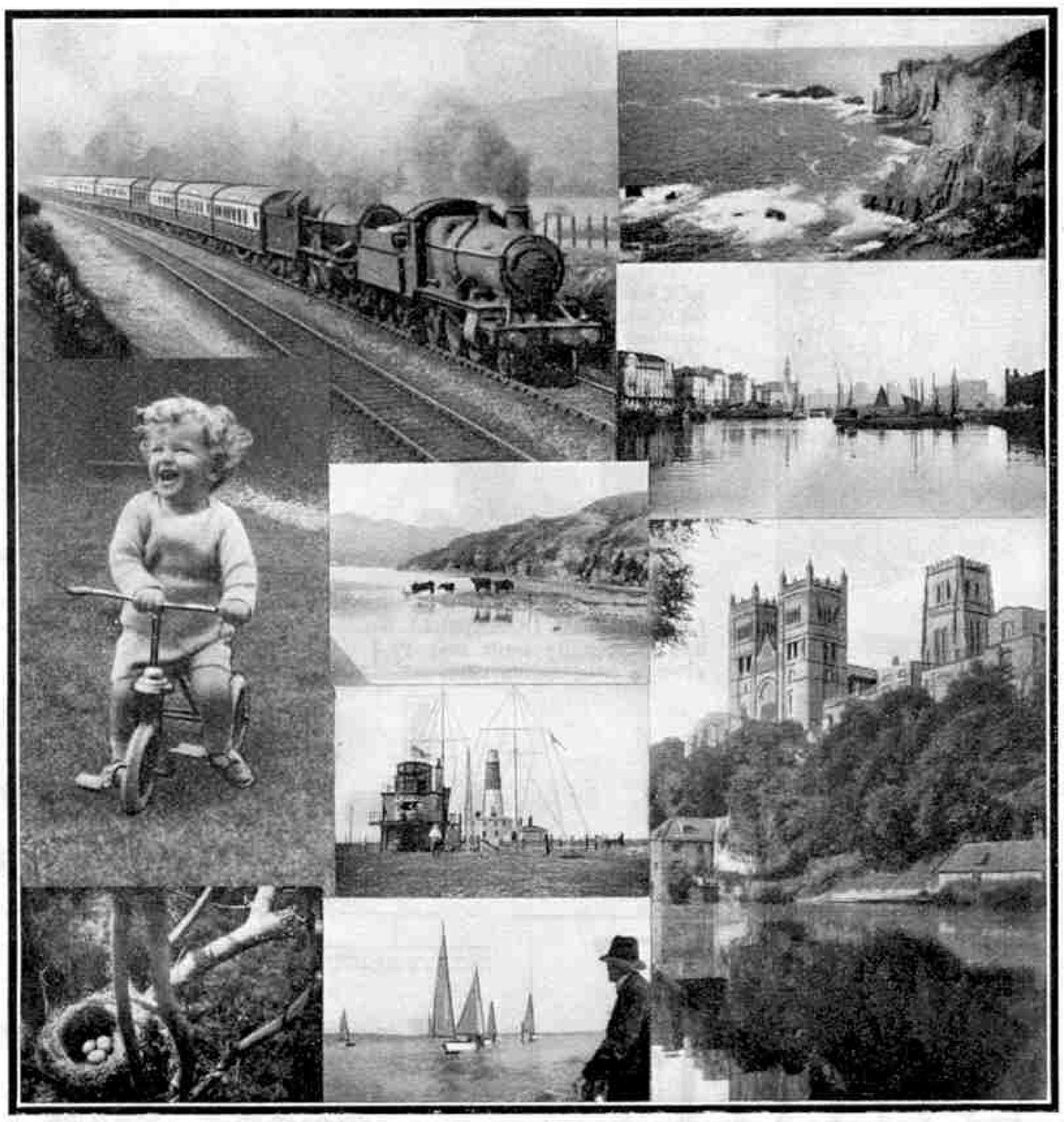
CHOOSING ENGLAND'S TEST MATCH TEAM

IN June of last year we had a voting contest to test our readers' views as to the composition of a cricket eleven to represent England in the fight for the Ashes. This proved one of our most popular summer contests, and a further competition on these lines should prove interesting, particularly in view of the Test Match to be played against the representatives of New Zealand now in Great Britain, and the necessity for building up a team for the Australian tour next winter.

Each competitor is asked to name the 11 players—amateurs are included in that term, of course—who, in his opinion, would constitute the best team that England could put in the field to-day. In order that the team shall be properly balanced, he should first select the captain, then the batsmen and bowlers and finally a wicket keeper should be chosen, each man selected being included primarily for his ability in his principal capacity. This composition does not exclude the "all-rounder," but obviously the essential qualification for the inclusion of any "all-rounder" must be outstanding ability in at least one department of the game. It must also be remembered that the batting or bowling abilities of the captain must be taken into consideration in addition to his capacity for leadership.

Prizes of Meccano products (to be chosen by the winners) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four entries that come nearest in order of merit to the team chosen by the massed vote of all the competitors.

Entries should be submitted on postcards only, the capacity in which each player is selected being clearly indicated. Entries must be addressed to "Cricket XI Vote, Meccano Magazine, Old Swan, Liverpool." Closing date, 31st July; Overseas closing date, 30th October.



A selection of successful prints from the April and May Photographic Contests. Reading from top to bottom the titles and competitors' names are as follows :—Left : The Cornish Riviera Ltd., G. S. Parker ; Sunny-Boy, Peggy Challis ; Missel Thrush's Nest, T. Ryan. Centre : Cattle at Barmouth, Miss A. Culverwell ; Dungeness Lighthouse, A. W. Butterworth ; Racing Yachts at Poole, J. D. Culverwell. Right : Land's End, F. H. Culverhouse ; Ostend Harbour, W. Minns ; Durham Cathedral, J. B. Gibson.

July Photo Contest

Our monthly Photographic Competitions this season are again being run to provide intending competitors with the widest possible scope, the prizes being offered for the best photographs submitted, irrespective of their subjects. The restrictions are very simple : the exposure must be the work of the competitor and a title must appear on the back of each print submitted.

This month's competition will be divided into two sections, A for competitors aged 16 and over, B for those under 16, and prizes of Meccano or Hornby Train products or photographic materials, as the winners select, to the value of 21/– and 10/6 respectively, will be awarded to the best and second best entries in each of the two sections.

Entries must be addressed "July Photographic Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and should reach this office not later than 31st July. The closing date for Overseas competitors will be 31st October.

Competition Closing Dates

HOME		
Test Team Voting Contest	...	**31st July.**
July Photographic Contest	...	**31st July.**
Electric Motor Essay ...	...	**30th September.**
OVERSEAS		
32nd Drawing Contest	...	**31st July.**
April Photographic Contest	...	**31st July.**
Missing Words Contest	...	**31st August.**
May Photographic Contest	...	**31st August.**
June Crossword Puzzle	...	**30th September.**
June Photographic Contest	...	**30th September.**
Electric Motor Essay ...	...	**30th September.**
Test Team Voting Contest	...	**31st October.**
July Photographic Contest	...	**31st October.**

Watch the Closing Dates :

Competitors, both Home and Overseas, are particularly requested to make a careful note of the closing dates of the competitions.

In sending entries to competitions that are divided into age groups, competitors should take particular care to mark their ages clearly on the back of the entry.

Entries, other than prize-winning efforts, for photographic, drawing and similar competitions, will be returned to the competitors concerned if a stamped addressed wrapper is sent with the entry, and its return requested.

COMPETITION RESULTS

HOME

April Photographic Contest.—First Prizes : Section A, J. Robertson (Dalmuir) ; Section B, D. G. Wraith (Bournemouth). Second Prizes : Section A, J. B. Gibson (Durham) ; Section B, F. W. King (Southwark, S.E.11). Consolation Prizes : A. W. Butterworth (Huddersfield) ; Miss A. Culverwell (Croydon) ; F. H. Culverhouse (Sheffield) ; J. D. Culverwell (Croydon) ; G. T. Earp (Loughborough) ; J. L. M. Hole (Bournemouth) ; G. S. Parker (Southampton).

32nd Drawing Contest.—First Prizes : Section A, N. Shacklock (Manchester) ; Section B, F. Dines (Rickmansworth). Second Prizes : Section A, J. D. Davey (Cultra, Co. Down) ; Section B, R. J. Naismith (Edinburgh). Consolation Prizes : C. Adams (Birmingham) ; P. Bell (Rotherham).

May Photographic Contest.—First Prizes : Section A, J. Robertson (Dalmuir) ; Section B, Miss P. Challis (Bexhill). Second Prizes : Section A, J. F. Huson (Upper Norwood, S.E.19) ; Section B, W. Minns (Durham). Consolation Prizes : D. E. Cooper (Witham, Essex) ; H. C. Kelynack (Haverstock Hill, N.W.3) ; T. Ryan (Cahirciveen, Co. Kerry) ; D. G. Wraith (Bournemouth).

OVERSEAS

Farmyard Drawing. J. G. Phillips (Cape Town) ; 2. R. Sewell (Wellington, N.Z.) ; 3. R. A. Davis (Sydney) ; 4. W. Fagg (Otago, N.Z.).

Broken Resolutions.—1. J. D. Siddons (Wainwright, Alta.) ; 2. R. B. Anderson (Burma) ; 3. F. Thomas (Cape Town) ; 4. S. Evans (Auckland).

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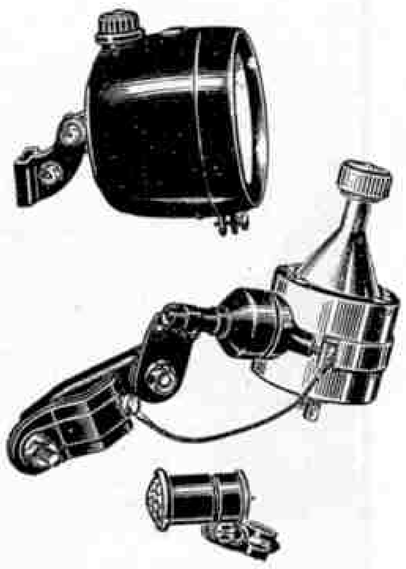

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LUCAS DRY BATTERY ELECTRIC LAMP No. 69. Very strong, gives good light, has carrying handle. Complete, **Price 3/3**

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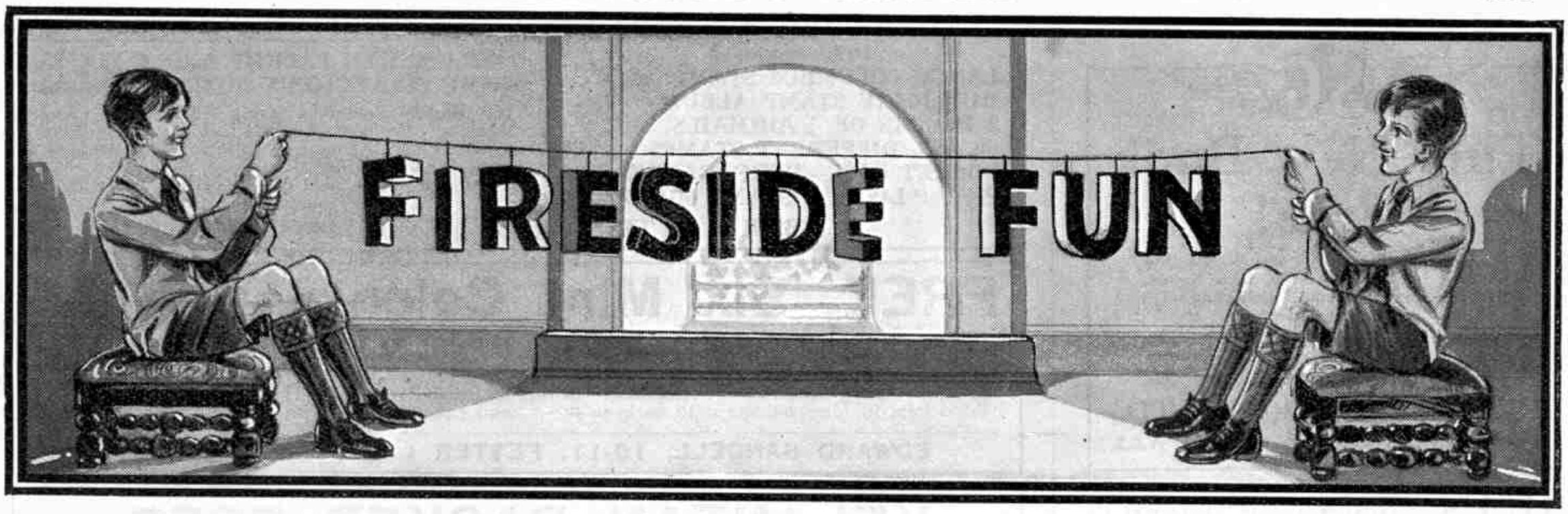

THE ESCAPE OF A LIFETIME

The big-game hunter had just finished his most hair-raising story.

"And do you mean to say that after that amazing adventure you lived to tell the tale?" asked an impressed listener.

"Yes," broke in a long-suffering club member, "And he's done nothing else ever since."

* * * *

"Do men ever go to heaven, mother?"

"Of course they do, dear."

"But I've never seen a picture of an angel with a beard or a moustache."

"No, darling, men only get to heaven by a very close shave."

* * * *

The clergyman at a holiday resort was announcing the results of the last Sunday's collection.

"I am glad to say that £21 0s. 1½d. was obtained," he remarked. Then he added with a smile, "I am forced to the conclusion that we have a visitor from Aberdeen holidaying in our midst."

"Ye're wrong, sir," shouted a voice from the back of the church. "There are three of us."

* * * *

The young man had just sung a song of his own composition to a music publisher.

"Well," he demanded proudly, "what do I get for it?"

The listener slowly regained his composure.

"I'm a publisher, not a magistrate!" he said regretfully.

* * * *

"Please, Mr. McCann, is Angus in?"

"Aye, we're giving a wee pairty the nicht, and he's doon in the shed shairpening the gramophone needles."

* * * *

The man who was smoking a very bad cigar ignored the protests of the other passengers.

At the next stop one of the latter called the guard and informed him that the cigar-smoker was travelling first-class with a third-class ticket.

The guard having turned out the offender, the other passengers asked the strategist how he knew that the cigar-smoker was a third-class ticket holder.

"His ticket was the same colour as mine," was the reply.

* * * *

WORK FOR A SKILLED MAN

A navvy was leaving the stores with an oil can in his hand when the foreman stopped him.

"Hey, what are you going to do with that oil can?" he demanded.

"I'm going to oil my wheel-barrow," was the reply.

"Just put it back," returned the foreman. "What do you know about engineering?"

* * * *

Teacher: "The people who live in the Arctic regions have a night that lasts for several months."

Pupil: "Please, sir, who calls them when it's time to get up?"

A SHAME TO WASTE IT

McAndrew had been buying a few things at the local chemist's shop. As he was collecting his change he knocked over a bottle of iodine and smashed it. Most of the liquid was spilt on his clothes. Noticing this, McAndrew dashed for the door.

"You needn't be afraid," the chemist shouted after him. "I won't make a charge for it."

But McAndrew never slackened his pace.

"It isna' that," he bawled over his shoulder. "I'm awa' hame to cut my finger."

* * * *

THE OPTIMIST

The old man was sitting on the roof, gazing placidly across the rushing waters.

"Washed all your fowls away?" asked the man in the boat.

"Yes, but the ducks swam," smiled the old man.

"Tore up your plum trees?"

"Don't mind it much. They said the crop would be a failure."

"But the flood! It's up to your windows!"

"Well, them windows needed washing, anyway, my friend."

* * * *

Diner: "Have you any wild duck?"

Waiter: "No, sir: but we can take a tame one and irritate it for you."

* * * *

A seaside visitor narrowly escaped walking over a concealed precipice. Naturally he was very angry, and when he saw a man working near the spot he thought he would have a few words with him on the subject.

"Do you know, my man," he commenced, "I nearly fell down that precipice? Why on earth don't you have a notice put up?"

"Well, sir," replied the workman, "we put a board up once, but nobody fell over, so we took it down again."

* * * *

Diner: "What is this, waiter, chicken or rabbit pie?"

Waiter: "Can't you tell by the taste, sir?"

Diner: "No, I can't."

Waiter: "Then what does it matter, sir?'

* * * *

As a special treat little Willie had been permitted to stay up for dinner, but he was told he must not ask for any of the good things on the table.

Silently he sat in his chair, watching the grown-ups as course by course was served. Nothing came Willie's way, and at last he could stand it no longer.

"Who wants a clean plate?" he asked.

* * * *

"Mother, Daddy said this is a camel hair brush," said Mary holding up a small paint brush.

"And so it is, dear," replied Mother.

Mary could scarcely believe this.

"What a terrible time it must take him to brush himself," she said.

MAKING SURE

The tramp had called at a Scotsman's residence.

"Will you give me sixpence to get a meal, sir?" he whined. "I haven't had a decent meal this year."

"No," said the Scot shortly.

"Will you give me threepence for a bed, then," continued the tramp.

"I might," replied the careful one. "But let me have a look at it first."

* * * *

"Do you ever have to hurry to catch your train in the morning," asked an employer of one of his clerks who had not been late for twenty years.

"It is fairly even, sir," replied the punctual one.

"What do you mean?" demanded the employer.

"Well, sir," replied the other. "Either I am standing on the platform when the train puffs in, or I puff in when the train is standing at the platform."

* * * *

The chemistry lesson was rapidly approaching its end and as usual the master was questioning the class about the work that had been covered.

"What do you know about nitrates, Jones?" he snapped suddenly to a boy who appeared to be inattentive.

"Er, they're much cheaper than day rates, sir," replied Jones, whose father was a telegraphist.

* * * *

A member of a London club had the habit of partaking of his soup in a boisterous fashion. The noise upset the others but they were too courteous to protest.

One day, however, when the offensive sounds were at fortissimo, a young and nerveless member strode toward the culprit and said: "May I help, sir?"

"Help!" repeated the partaker of soup; "I don't need any help."

"Sorry," said the youngster. "I thought that perhaps you might wish to be dragged ashore."

* * * *

Professor: "You can realise how far this star is from the earth when you consider that its light took several thousands of years to reach us."

Lady: "Yes, but the stars only shine at night; otherwise it would have got here quicker."

* * * *

Examiner: "When is a man entitled to be buried with military honours?"

Recruit: "Er, when he is dead, sir."

* * * *

MORE THAN COULD BE EXPECTED

The engineer, surveying the right of way for the proposed railroad, was talking to a farmer.

"Yes," he said, "the line will run right through your barnyard."

"Well," answered the farmer, "ye can do it, if ye want, but I'll not git up in the night just to open the gate every time a train comes through."

* * * *

Magistrate: "The signs all said 'Slow Down.'"

Motorist: "But how could I read them at the speed I was going?"

This New Book Free!

If you are interested in stamp-collecting, or want to start collecting, write for our FREE book, **Stamp Collecting—The World's Hobby.**

If you have not had them, ask also for our big lists of stamps and albums.

Approvals of any country on request.

STANLEY GIBBONS LTD.,

DEPT. S.15, 391 STRAND, LONDON, W.C.2.

Actual Contents:—

LARGE COLUMBUS STAMP
DUPLICATE STAMP ALBUM
2 BLOCKS OF 4 AIRMAILS
60 ALL DIFFERENT STAMPS
POCKET CASE—PERF. GAUGE
PKT. "LIVER" STAMP MOUNTS

"COLUMBUS" PACKET AND STAMP COLLECTOR'S OUTFIT FREE

This beautiful Columbus Stamp should be in every collection. This fine offer also includes stamps from Ceylon, Cuba (Gomez), Australasians, Hivatalos, Egypt (Fuad), Wallis Isles, N.Z., 25 unused, etc. ALL FREE. Just send 2d. for postage and request our famous approvals.

LISBURN & TOWNSEND (M.M.), LIVERPOOL

FREE Six Mint Colonials FREE

I send FREE SIX MINT BRITISH COLONIALS, one each from MOROCCO AGENCIES, ZANZIBAR, KENYA, TURKS and CAICOS Is., SOUDAN and CAYMAN ISLANDS—and ALL MINT, to any collector at Home or Abroad sending a postcard for my large Illustrated Price List (No. 9) containing over 1,200 items: Stamps, Albums, Sets, Packets, Accessories—in fact EVERYTHING FOR THE STAMP COLLECTOR. Prices from 1d. (over 200 sets at 1d. each) to 40/–. Send a postcard only—no cash—and ask for No. 200.

EDWARD SANDELL, 10-11, FETTER LANE, LONDON, E.C.4

SETS (POSTAGE EXTRA)

5 Argentine	...	2d.	20 Roumania	...	2d.
5 Brazil	...	2d.	20 Czecho	...	2d.
5 Costa Rica	...	3d.	20 Poland	...	2d.
5 Colombia	...	2d.	10 Dantzig	...	2d.
5 Ceylon	...	2d.	10 Greece	...	2d.
5 Chili ...	...	2d.	10 Turkey	...	2d.
5 Cuba ...	...	2d.	10 Bavaria	...	2d.
5 Ecuador	...	2d.	5 Algeria	...	2d.
5 Guatemala	...	2d.	6 Azores	...	2d.
5 Honduras	...	2d.	10 Bulgaria	...	2d.
5 Mexico	...	2d.	10 Finland	...	2d.
5 Nicaragua	...	2d.	10 Russia	...	2d.
5 Salvador	...	2d.	10 Japan...	...	2d.
5 Siam ...	...	2d.	10 China	...	2d.
5 Saar ...	...	2d.	5 Persia...	...	2d.
5 Panama	...	2d.	10 ,,	...	4d.
20 French Cols.		2d.	15 ,,	...	6d.

J. RUSSELL

Chetwynd, Shanklin Drive, Westcliff-on-Sea

KELANTAN PACKET FREE

A fine packet of all different Stamps containing a fine **Kelantan** pictorial, a handsome **pair of French Morocco** high values, 25c. and 50c. large pictorials, a **set of 3 Siam,** 1930 large head, **Kenya and Uganda, S. Rhodesia,** pictorial, a **set of 3 Roumania, Azores,** high value 40c., **Travancore,** latest issue of **Egypt,** etc., free to all asking to see my famous approval sheets and **enclosing 2d. for postage and packing (abroad 3d.).**

Albums 1/4, 1/10, 3/–, 4/–, 6/–, 7/6, 10/–, and upwards.

S. HAMMOND, 2, CHESHAM FIELDS, BURY, LANCS.

FREE! 10 Splendid EGYPT

Including old issues, **Pyramids** and **Sphinx,** Native Boats on the **Nile,** Sphinx Head, the **Colossi** of **Thebes, King Fuad,** Service Stamps, etc. I will send this collection **absolutely free** to all Stamp Collectors sending 2d. postage (abroad 3d.). Only one gift to each applicant.

G. P. KEEF, Mortimer Lodge, Wimbledon Park, London, S.W.19

THE

"NEW ORIENTAL" PACKET

Owing to the enormous success of the "Oriental" Packet, I am now offering a slightly different Packet of Orientals of even better value. **30** Stamps in all: **EGYPT** (large pictorial, etc.), fine Set of **6 TURKEY** (pictorials, etc.), Set of **PALESTINE, SYRIA** unused, Set of **ALGERIA,** including high value, **MESOPOTAMIA,** Set of **TUNIS** new issues, etc., **ALAOUITES** (Minaret), **GREEK** surcharged, a beautiful Set of **MOROCCO, AIRPOST,** etc. Price **4½d.,** postage **2d.** (abroad **3d.** extra). **PURCHASERS OF THE ABOVE PACKET** asking for Approval Sheets will be presented with a unique Set of **10 PERSIA** (usually sold at **1/6**). Satisfaction guaranteed or money returned. Senders of Addresses of Stamp Collecting Friends will receive in addition another Set **FREE.**

10 PERSIA FREE

H. C. WATKINS, "M" Dept., Granville Road, BARNET

The World's Finest Approval

sheets are at your disposal. For 51 years we have made a speciality of sending out sheets of stamps on approval. Ask to see some and compare the quality and prices with those of other firms. To all applicants enclosing 1½d. for postage we will present, gratis, six Pictorial Stamps of Saar if the application is addressed to **Department 119,**

ERRINGTON & MARTIN,

South Hackney, London, E.9. Established 1880.

1000 DIFFERENT STAMPS 1000

ON APPROVAL

from which you may select any 100 for 3/–. This selection is **not** made up of the thousand commonest stamps, but contains specimens priced by Stanley Gibbons up to 1/– each. For 3/– you have the opportunity of choosing 100 stamps of the catalogue value of 20/– or more.

H. HARDY, 285, Archway Road, London, N.6.

Bechuanaland Packet Free

A Fine Large Packet of **485 Guaranteed Unsorted Foreign Stamps** just as Imported from **Abroad,** including scarce **British Bechuanaland, Set 4** unused Pictorial **Belgium, Set 4** unused Pictorial **French Equatorial Africa, Brazil, Chile, Argentine, Paraguay, Iceland,** etc. **Free** to Genuine applicants asking for **Half-price** Approval Sheets, enclosing **2d.** postage (Abroad 6d. P.O.). Mention Bechuanaland.

Special Offer. 1,000 All Different stamps. 3/– post free.

HORACE MILLER & CO., WHITSTABLE, KENT.

FREE

MONTENEGRO PACKET. 100 DIFFERENT STAMPS. PERFORATION GAUGE.

This wonderful offer includes set of 5 Montenegro (1896 Monastery stamps), Columbus stamp, Turkey, over 25 British Colonials, Egypt, many unused high values, etc. Perf. Gauge. FREE TO APPROVAL APPLICANTS.

J. BURTON, 31, ONSLOW RD., LIVERPOOL.

*9 **Nyassa Triangular,** 1924.	Complete set ...	6d.
*14 **Antioquia,** 1899.	Complete set (Cat. 2/11)	6d.
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* Unused. Postage 1½d. extra.

W. BENNETT, 53, Marlborough Road, London, E.8.

DO YOU COLLECT Fine Used British Colonials? Then ask to see my collection of 600 different at ½d. each Stamp, the best value at the lowest cost. Sent on request. A good selection at 1d. each and upwards if desired. Duplicate Stamps Bought or Exchanged.

BICKERS, Elveden, Lordswood Avenue, Southampton.

SOUTHERN RHODESIA

A new set of Pictorial Stamps from this British Possession sent free of charge to bona-fide applicants for selections of duplicates on approval. If **2d.** is enclosed for postage a new set of **Rarotonga** stamps also given free. 500 different stamps (extra good) post free **1/6.**

HENRY TURNER,

110, Barnett Road, Preston, Brighton, Sussex.

"DIAMONDS"

MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet,** which is guaranteed to contain 1,000 Unsorted Stamps from Convents abroad, **1/3**; 2 packets, **2/5**; 3 packets, **3/6**; 4 packets, **4/6**; 5 packets, **5/6.** All post free. (Abroad 3d. per packet extra).

O. NERUSH, Importer

(Dept. E), 68, Turnpike Lane, Hornsey, N.8.

100 DIFFERENT STAMPS FREE. Send for ½d. Approvals.—Cox, 21, Dennis Mansions, Westcliff.

25 Egypt, 6d.; 25 Syria, 10d.; 25 Grand Liban, 1/–; 50 Turkey, 1/–. All different. Post extra. —J. Agius, 88, Str Mercanti, Valletta, Malta.

Join the Dale Stamp Exchange—no entrance fees, particulars—50, Firdale Rd., Walton, Liverpool.

18 **Nyassa,** 1921-3,	Pictorials	1/9
4 **Persia,**	Pictorial Air Mail	6d.
6 **Italy,** 1931,	St. Anthony Pictorial	7d.
8 **Spain,**	Pope and King	5d.

Postage 1½d. extra. Try my Approval Selections.

J. R. MORRIS, 9, Audley Road, Folkestone, Kent.

LATEST STAMP CASKET FREE!

Everything for Stamp Collectors in Pictorial Metal Case.

WITH SCARCE PERSIA HORSE-POST (Cat. 1/6).

Contained in the **Free Casket** are Matlock Tweezers (with spade ends), Crystal Clear Envelopes, Marvellous Matlock Mounts and a **Rare Persia Resht-Teheran Horse-Post Issue** (Cat. 1/6). The Handsome Metal Gift Casket has hinged Lid, showing in colour **The Highest English Precipice** at Matlock. It also combines in a unique way a **Watermark Detector** and an **Accurate All-Metal Perforation Gauge.** Send only 3d. postage, or if you would like a **Powerful Magnifying Glass** as well, 4d. in all must be sent.

Ask for Approvals.

VICTOR BANCROFT, MATLOCK, ENGLAND.

Stamp Gossip

and Notes on New Issues

The King's Collection

It is common knowledge among stamp collectors that the collection formed personally by H.M. King George, is one of the finest in the world. His collection of British issues is matchless and contains many unique items, including Rowland Hill's rough water colour sketches for the first penny and twopenny stamps issued in 1840, and early proofs of most of the issues made during the reigns of Queen Victoria and King Edward. Another interesting item is an early shilling stamp of Great Britain that appears to be unique, for no other stamp pulled from the same plate is known. His Majesty paid £400 for this stamp, but its value to-day would be at least £600!

The King's collection is housed in no less than 200 albums, all of them bound in the royal colours.

New British African Issues

Among the many interesting stamp issues of recent months, the new pictorial issue for South West Africa will take high rank. It consists of 12 stamps for general postal use, ranging from ½d. up to 20/– in denomination, two for air mail use, 3d. and 10d., and five postage dues, ½d., 1d., 2d., 3d. and 6d.

There is a separate design for each value in the general issue, characteristic scenery in South West Africa and illustrations of native plants or animals being used principally. The designs of the two air mail stamps also differ, the 3d. showing a monoplane and the 10d. a biplane.

The stamps were engraved and recess printed by Messrs. Bradbury Wilkinson & Company, and the inscriptions are given in Afrikaans and English on alternate stamps. The air mail issues are illustrated at the head of this page, and we hope to give a full description of the designs of the general issue in a special article to appear later this year.

Southern Rhodesia's new general issue has also made its appearance, but in this case the long set of 13 values calls for only two designs. The ½d., 1d., 4d., 6d., 8d., 10d., 1/–, 1/6, 2/– and 5/– values take a King's Head design of a new and very attractive style, while the 2d. and 3d. values show a view of the Victoria Falls. The 2d. value is illustrated on this page.

The old stamps bearing the King's portrait will be demonetized on 30th September.

Another Indian Commemorative

The Native States of India have always proved a source of interest to young stamp collectors, but Jaipur's issue of 14th March, in celebration of the investiture of H.H. Mar Singh II as ruler, seems to have passed almost unnoticed. Presumably it was overshadowed by the great popularity of the New Delhi issue, described in the May "*M.M.*"

The new Jaipur issue consists of 12 stamps with values ranging from ¼A. to 5R. The designs cover a great variety of subjects, from the Sun God Chariot of the ¼A., illustrated here, to the two portraits of the late ruler, Jai Singh II, and the new Maharaja, appearing together on the 5R. The intervening stamps show a portrait of the new Maharaja (½A.), an elephant with the State banner (1A.), dancing peacocks (2½A.), a bullock carriage (3A.), and several of the principal buildings of the State on the 6A., 8A., 1R. and 2R., respectively.

The 2A. stamp probably will go down in philatelic history as the "hobby horse" stamp. Officially the design shows a Sowar in armour, but the draped and unhappy looking horse resembles nothing so much as the burlesque animal of a carnival parade!

The designs generally are carried out most attractively, however, and the issue is among the most interesting of recent years from the Indian Native States.

New Iraq Stamps

Readers probably will have difficulty in realising that the handsome gentleman portrayed on the lower values of Iraq's new issue is the shrouded King Feizal of the previous issue. One must accept the implication that they are portraits of the same person and take the stamps as an illustration of the tendency of Oriental peoples to become westernised.

The Iraq pictorial issues have enjoyed great popularity among collectors, and their passing will be regretted. The new issue, however, is of distinctly fine design and, moreover, is likely to have only a very short life, for a new currency is replacing the annas and rupees of the present issue.

* * * *

New Zealand is contemplating an entirely new issue of postage stamps and designs have been invited. A premium of £25 will be paid for any design adopted.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Unique Air Mail Cover

What is certainly one of the most remarkable air mail covers in existence is hanging in a frame in the private office of the President of Uruguay at Montevideo. Almost the entire surface, back and front, is covered by stamps to a total face value of £26/17/2! This remarkable cover is of special interest to English collectors, as its origin was the General Electric Company's office at Birmingham.

The letter was sent by the G.E.C. to one of its representatives in Montevideo. On the day of despatch the Birmingham Post Office's supply of high value stamps was very low and only seven £1 stamps, of the special Postal Congress Union issue, were available. The balance of the charge had to be made up with 10/–, 5/–, 2/6, 1/– and 6d. stamps.

It is believed that the seven £1 stamps were the only pound stamps of the special Postal Congress Union issue that were issued from Birmingham for actual use on a letter.

Java-Australia Air Mail

In days to come there will be a record in the stamp catalogues of a first air mail to Australia. But, unfortunately, that record will not be on a British stamp.

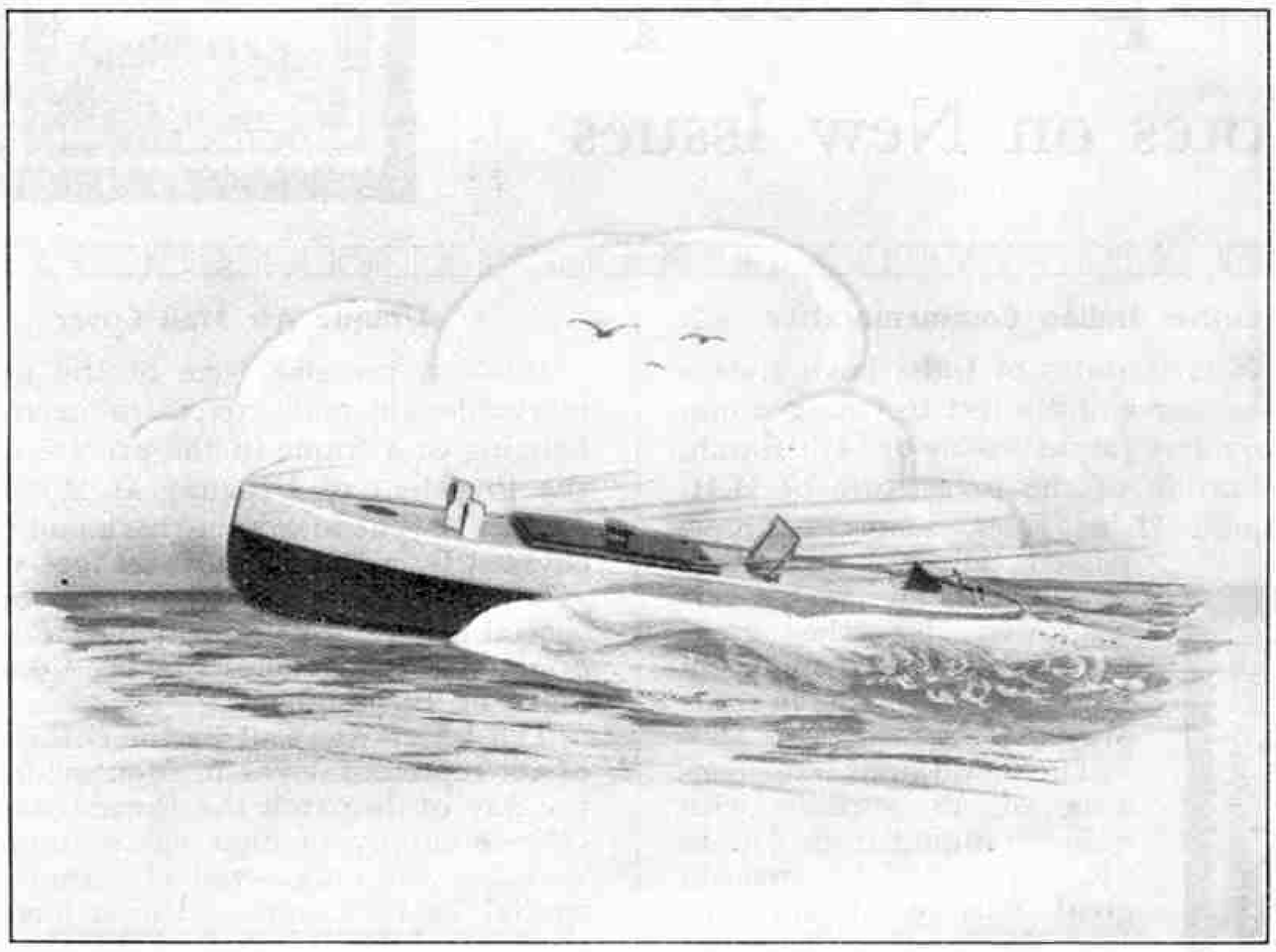
Holland celebrated the first flight on the extension of the K.L.M. Amsterdam-Java air route into Australia by issuing the special air stamp illustrated on this page. The stamp maintains Holland's reputation for striking originality in air stamp designs.

Stamp Booklet Advertisements

Denmark is the latest country to link up the stamp collector and the advertiser. The postal authorities there have issued four stamp booklets, each devoted to the advertising of one firm.

The advertisements in the first booklet are those of the Copenhagen Coal and Coke Company, and on its interleaving sheets appear photographs of operations in the importation and delivery of coal. The second booklet contains the announcements of Messrs. Galle & Jessens, manufacturers of cocoa and chocolate. The other booklets feature the newspaper "*Berlingske Tidende.*" In one there is a subscription order form and in the other a voucher entitling the holder to a fortnight's free delivery of the paper. Gibbons offer these booklets at 1/6 each.

Which are YOU having?



When it comes to choosing your speedboat this year ask your dealer to show you the new Sutcliffe Steel Speedboats.

You will like their smart appearance but examine them closely and you will see that they are just what you want. Almost unsinkable, easy to wind, handy starting lever, adjustable windscreen, cellulose finish—in fact everything to make you feel that these models are really the best.

TRUE AS STEEL

The use of steel in their construction prevents any warping, swelling or splitting, and the boy who owns a Sutcliffe Steel Speedboat is proud of it because he knows it is really good and in every way as "true as steel."

Prices complete with powerful clockwork motors :

6/6 10/6 15/-

(15/- model illustrated).

SUTCLIFFE STEEL SPEEDBOATS

Sole Manufacturer: J. W. SUTCLIFFE, HORSFORTH, LEEDS

Boys! You must have SECCOTINE

Regd. Trade Mark

The World's Strongest Adhesive

Where an adhesive has to be used and where the joint must be as strong as iron, Seccotine is chosen! Why? Because Seccotine grips like a giant, because it is the world's greatest sticker!

Seccotine was used to mend the mast of the famous yacht "Shamrock" III. Just remember that when you are making models or mending anything. Ask your Dad for a tube of Seccotine and follow the example of the Royal Air Force, the Admiralty, etc., etc. Ask your Dad, too, to write for an interesting free booklet.

Seccotine is obtainable everywhere in tubes **4½d., 6d.** *and* **9d.**

(*Dept. M*) McCaw, Stevenson & Orr Ltd., The Linenhall Works, Belfast

"GREYHOUND" Racing Motor Speed-Boats

As demonstrated on the Motor Boat Pond at the Schoolboys' Exhibition.

The "GREYHOUND" Motor Boats are built for speed, streamlined and equipped with strong motors, both Clockwork and Electric. 2-blade brass propellers and brake control.

CLOCKWORK

GREYHOUND No.	6	Length 12¼″	**4/6**	each
	7	„ 16¼″	**7/6**	„
	8	„ 20½″	**10/6**	„
Superior finished, extra powerful Clockwork	V	Length 21″	**17/6**	„
	IV	„ 25″	**22/6**	„

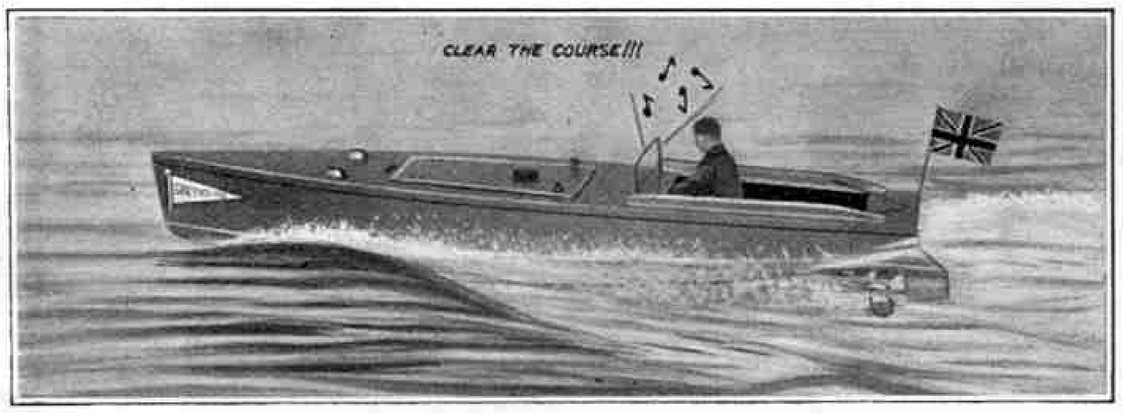
ELECTRIC

GREYHOUND No.	9	Length 21″	**17/6**	each
SUPER GREYHOUND	III	Length 25″	**25/6**	„
„ „	I	„ 25″	**35/–**	„

No. I has 2-Speed Regulator worked by Two Batteries.

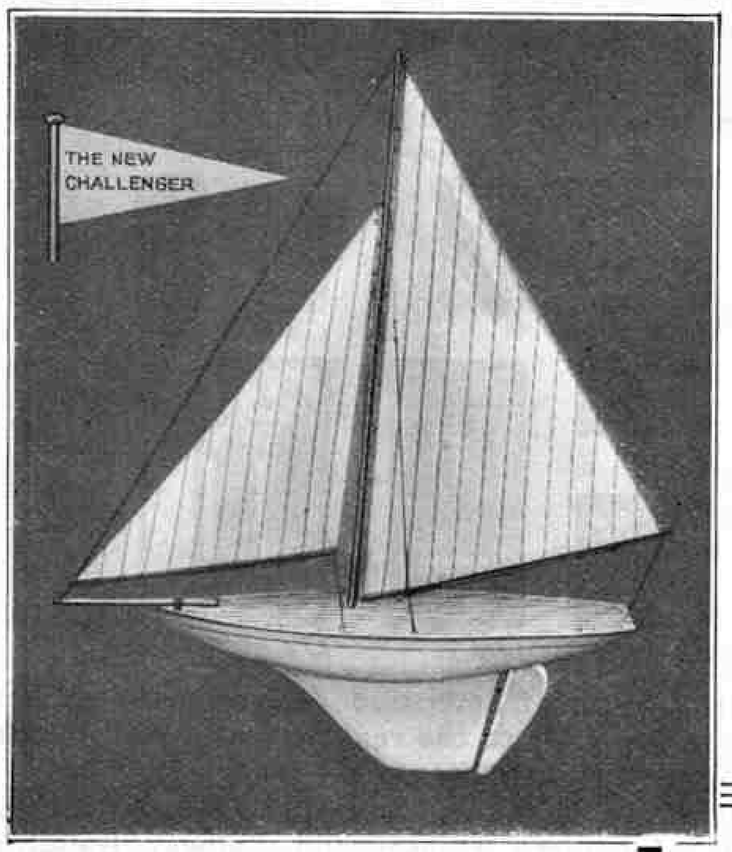
NEW ! Outboard Electric Motor. Very powerful action. Driven by three Pocket Batteries. Will attain great speed. Beautifully finished. 28″ long. Patent 33832.

50/-



The Silver "**GREYHOUND,**" 25″ long, a beautiful model. Powerful Clockwork, with intermittent **Siren.** Works automatically from Pocket Battery. Patent 33132.

30/-



The new 1931 "CHALLENGER" Yachts

White enamelled hull with blue line, balanced rudder, weighted Keel, the lead being inset into the wood Keel, which avoids the possibility of the heavy lead Keel becoming detached.

Varnished and lined decks, brass fittings. Sloop rig with Bermuda Lugsail and Staysail of best quality striped Sailcloth, Foresheet and Mainsheet running free on Deckhorses, which allow the Sails to adjust themselves, thus enabling the Yachts to tack automatically. Very simple to rig. The Mainmast has three supporting shrouds. Altogether, these Yachts have a most pleasing appearance and beautiful lines.

The broad beam, combined with this particular sloop rig, gives the most satisfactory results in light and stiff breezes.

BUY BRITISH

•

EVERY YACHT GUARANTEED

The New "Challenger" British-built Yachts are second to none. Made in the following sizes—

14″	**7/6**	23″	**27/6**
16″	**10/6**	25″	**35/–**
18″	**15/–**	30″	**45/–**
21″	**21/–**	36″	**63/–**

The larger sizes, 30″ and 36″, are provided with two sets of sails and spars—a full size set of sails (for sailing in light to moderate breeze) and the small set, for use in a stiff breeze.

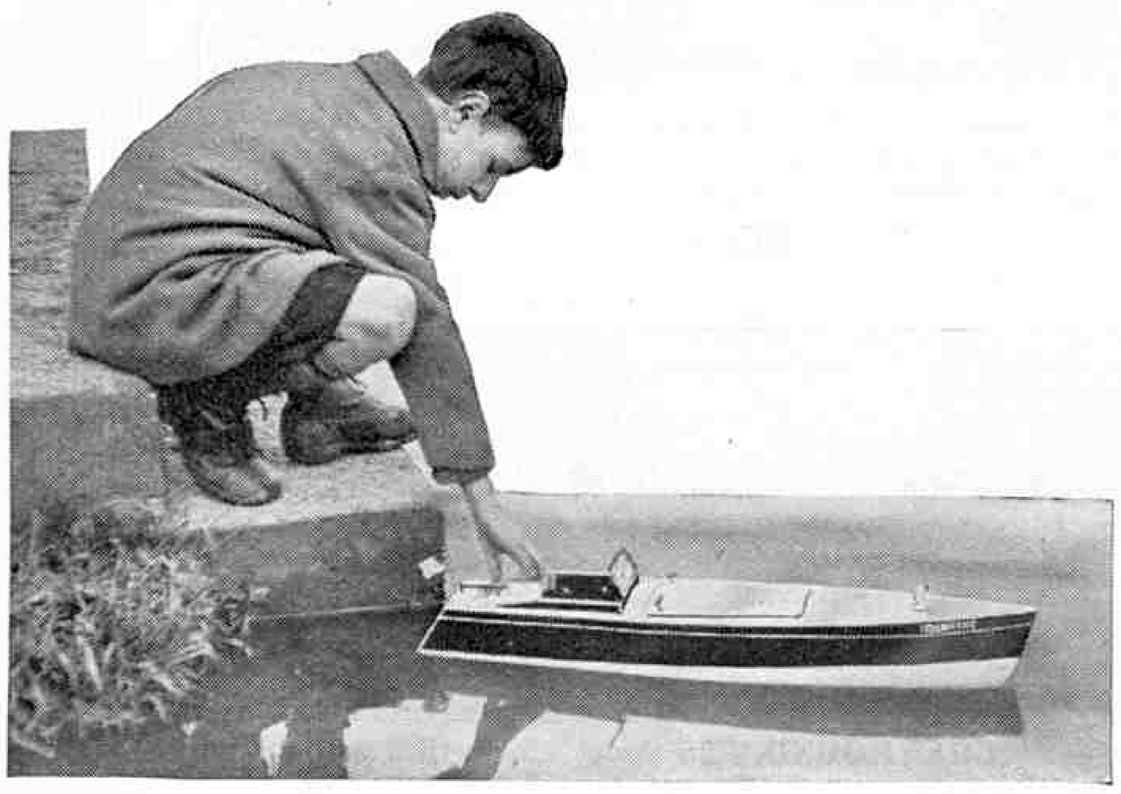
If unable to obtain from your Store or Dealer, write to the Manufacturers

A. J. HOLLADAY & CO. LTD.,

3, Aldermanbury Ave., LONDON - - E.C.2

A Tense Moment!

The IOLANTHE, Bassett-Lowke's latest masterpiece in motor boats, rides the waves ready for a record run! Her proud owner, eyes sparkling in anticipation, gives a final touch to the helm, sets the motor humming and then . . . . . SHE'S OFF, ... leaving a trail of foam in her wake!



Every line and curve of the IOLANTHE indicates speed. This quality is especially in evidence below the water line. She will show a clean pair of heels to anything in the same class!

No boy should buy a motor boat until he has seen these spanking new models.

Clockwork or Electric

Extra large hull, 27½ ins. long; beam, 5½ ins.; depth, 4¼ ins. In both clockwork and electric models, the motor is mounted on a separate baseboard, easily removable as a whole, enabling ready inspection. The electric model runs from two pocket batteries. Both models have large ventilator, windscreen with brass frames, brass stern tube and propeller shaft, mahogany cockpit with seat.

Magnificently finished, in Blue and White, or Black and White, with gold lines.

Prices:

Clockwork	Electric
32/-	35/6

Many other models are described in our Ships' Catalogue, now ready, price 6d. This contains motor boats, sailing yachts, liners and everything for the model ship builder. Ask for Catalogue No. S/17.

When in London or Manchester call at Bassett-Lowke Ltd. and see the wonderful show of models of every description. If you are passing through Northampton call and see them being made—*in any case* send for our new Catalogue "Everything for Models," over 300 pages, fully illustrated. Ask for Catalogue No. 17 and send one shilling.

BASSETT-LOWKE LTD.

NORTHAMPTON

LONDON 112, High Holborn, W.C.1.

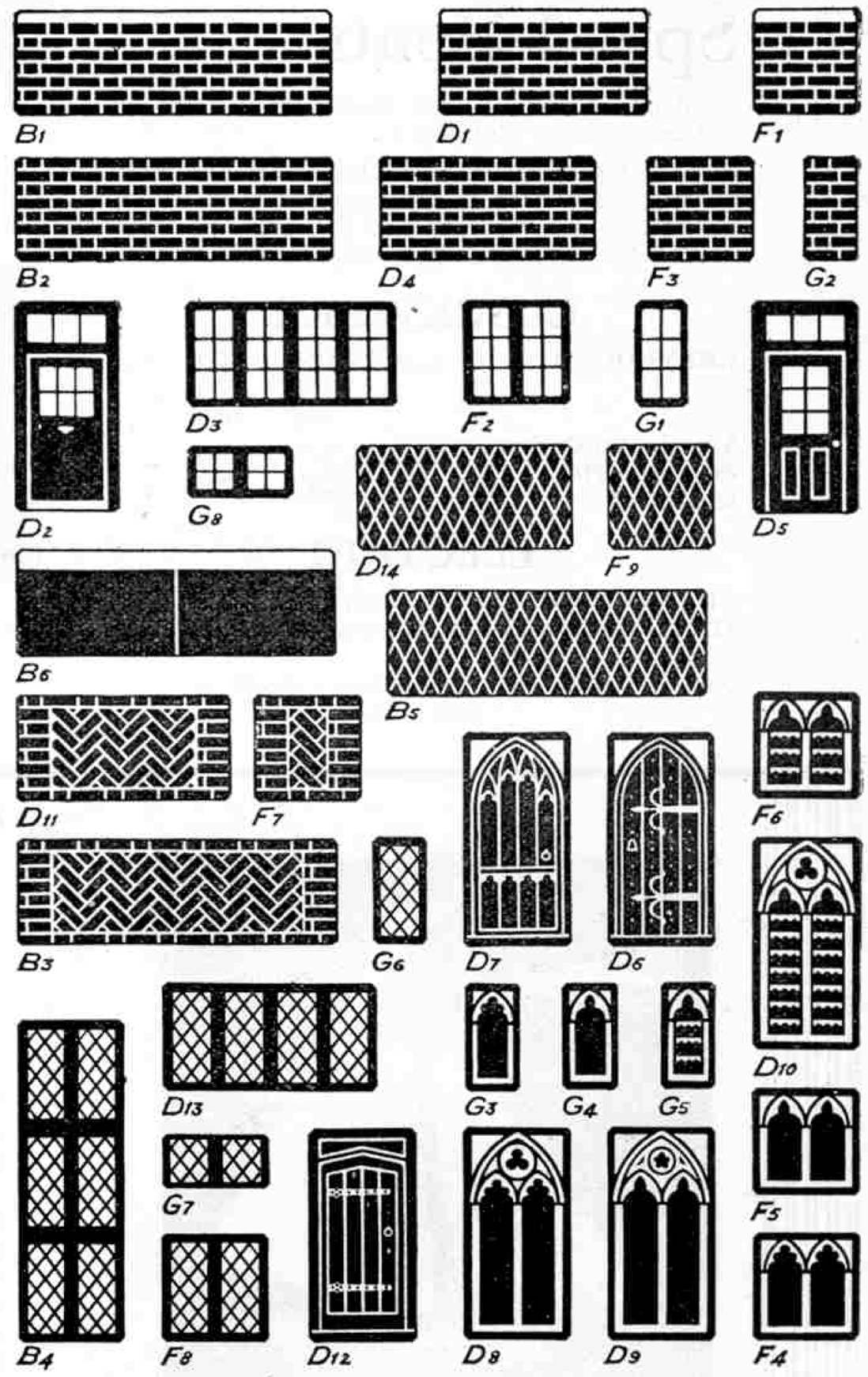
MANCHESTER 28, Corporation Street.

EDINBURGH—At Anderson's, The Arcade, 105, Princes Street.

EMBOSSED DESIGN BRICKS

FOR USE WITH

LOTT'S BRICKS



THE introduction of embossed design bricks to Lott's Bricks, adds very greatly to the realism and charm of the miniature buildings that can be made.

The designs shown on the top half of the diagram are for inclusion in all kinds of modern Houses and Railway Buildings. Those numbered B5, B6, D14, and F9, are for use in the construction of Railway Platforms.

The Herringbone bond base bricks and diamond paned windows on the bottom left side may be used for making very delightful old-fashioned Houses, Halls, etc.

The designs on the bottom right side help to make really perfect models of Churches and Chapels.

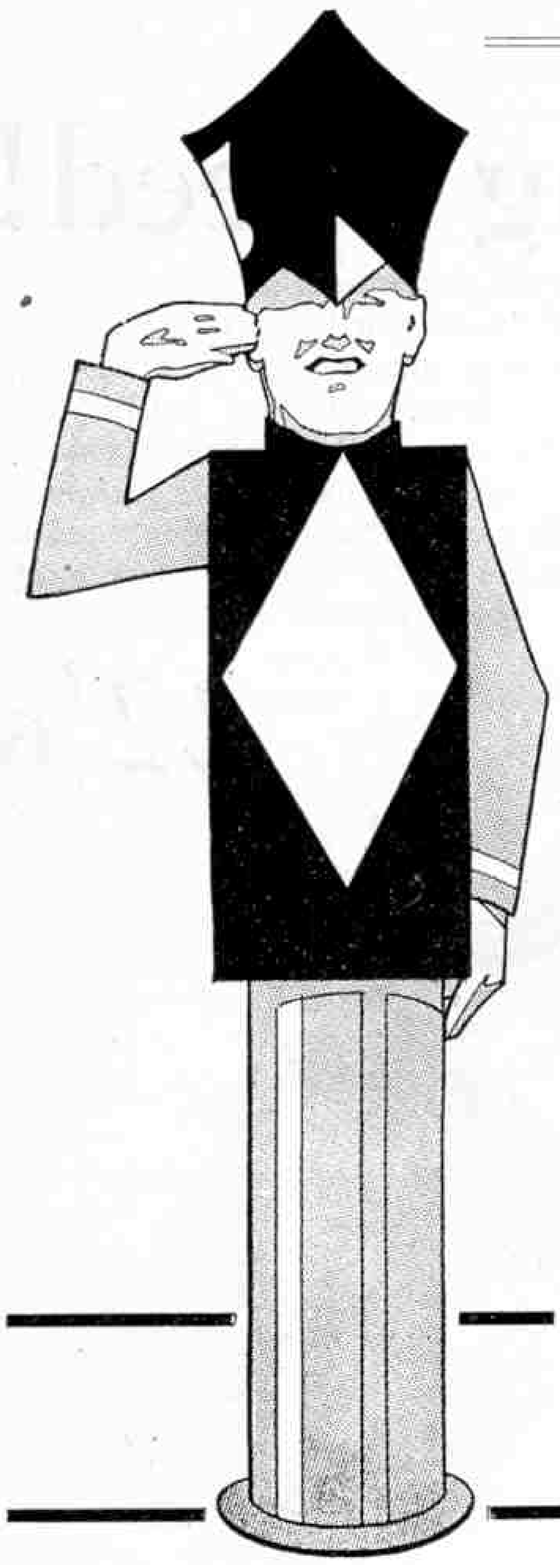
These bricks may be obtained loose through all Lott's Bricks dealers and are priced as below. See the special display frames.

B's 2½d. each, D's 2d. each, F's 1½d. each, G's 1d. each.

All the embossed design bricks are appropriately coloured, and are suitable for use with either Lott's Bricks, Tudor Blocks, or Lodomo.

A Sheet illustrating the bricks in their colours will be sent free on receipt of a post-card.

LOTT'S BRICKS LTD., WATFORD, HERTS.



Selo is the best film . . . all the time!

On your holidays—at the seaside, camping, hiking, in the parks or the country, wherever you may be, there are ample opportunities to take some fine snaps. If you make sure that Selo is in your camera, you can be certain that the results will be all right. So buy Selo—and carry your camera ready loaded!

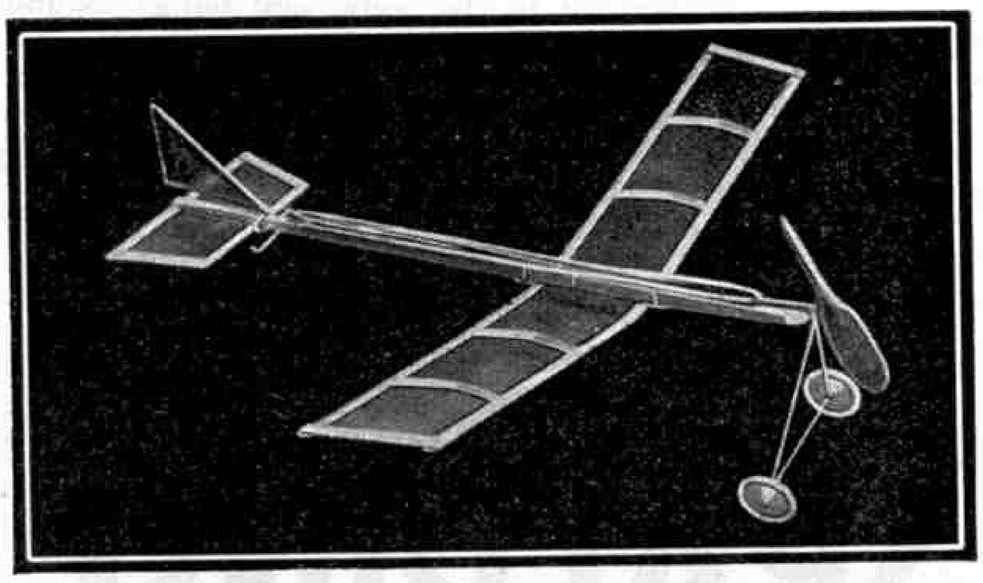
SELO
The fast FILM
BRITISH MADE

Fits every size and make of camera

THE SAFEST WAY TO TAKE COMPETITION PICTURES IS TO LOAD YOUR CAMERA WITH SELO—*made specially for snapshoters!*

THE NEW "SKISAIL" TRACTOR MODEL AEROPLANES

Constructed of highest quality materials. Perfect flight guaranteed.
Patent No. 23533. Patent No. 138210.



All models fitted with **Patent Adjustable Rudder** which controls flight of aeroplane in any direction, **New Lightweight Shockproof Chassis and hand-carved Propeller.**

Wing Span of 18/6 Model 33 in. Fitted with Patent Safety Chassis with Landing Skids, Wing span of our 4/6 model 21 in.

No. 0	Price	18/6
„ 1	„	14/6
„ 2	„	10/6
„ 3	„	8/6
„ 4	„	6/6
„ 5	„	4/6

The "Skisail Model de Luxe"
Wing Span 42 in. Price 27/6
The "Skisail" Monoplane Constructional Set 10/6
Postage 6d.

"SKISAIL" MONOPLANES are obtainable from the leading Stores, Toy and Sports Dealers, including Selfridges, Whiteleys and Gamages.

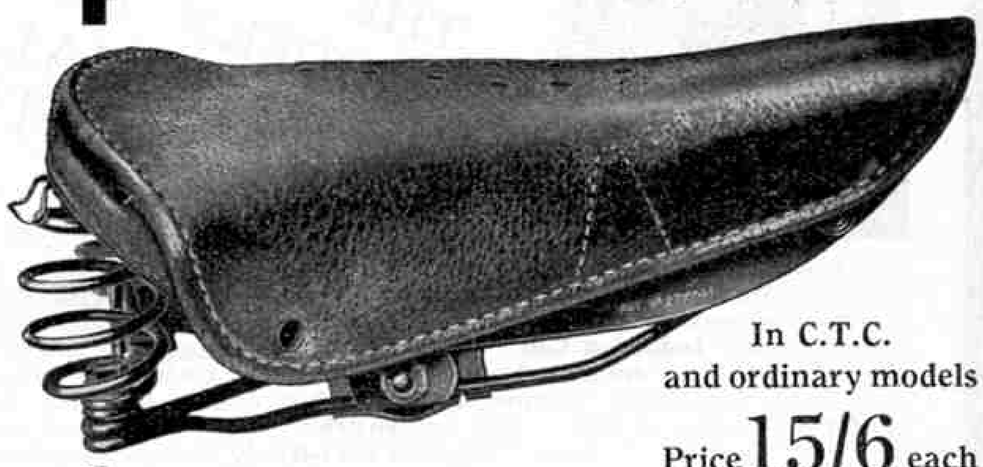
If unable to obtain from your local dealer send order direct to—

PATENT MODEL MANUFACTURERS,
159, Lymington Avenue, Wood Green, LONDON, N.22.
'Phone: TOTTENHAM 3278.

It saves your tyres!
does the **"TERRY"**
SPRING SEAT SADDLE

Boys, think of it—more miles, harder wear, and yet at less cost on your tyres.
Here is the secret of it—When you fit a "Terry" you are able to ride with your tyres as hard as steel.
Consequently, there is a smaller area of the tread in contact with the road surface.
With a "Terry" you can ride over anything, and your hard tyres carry you faster and over far greater distances without causing fatigue.
You can do a day's ride of 60-80-100 miles without saddle soreness.

BUY A "TERRY" NOW



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Price **15/6** each
State your weight when ordering.

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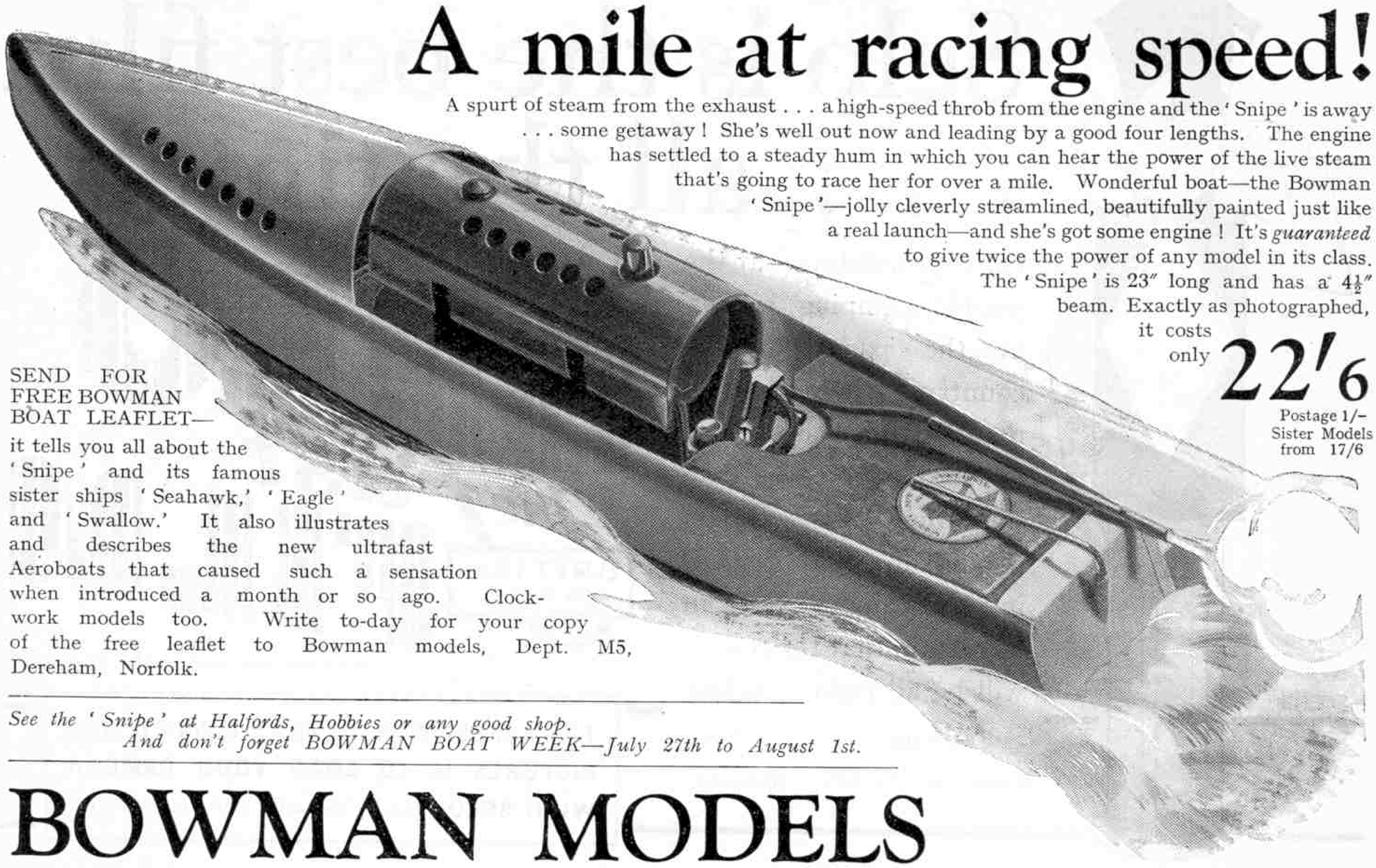
You must have these books.

HERBERT TERRY & SONS LTD., Manufacturers,
REDDITCH, Eng. **Est. 1855.**

A mile at racing speed!



A spurt of steam from the exhaust . . . a high-speed throb from the engine and the 'Snipe' is away . . . some getaway! She's well out now and leading by a good four lengths. The engine has settled to a steady hum in which you can hear the power of the live steam that's going to race her for over a mile. Wonderful boat—the Bowman 'Snipe'—jolly cleverly streamlined, beautifully painted just like a real launch—and she's got some engine! It's *guaranteed* to give twice the power of any model in its class. The 'Snipe' is 23" long and has a 4½" beam. Exactly as photographed, it costs only **22/6**

Postage 1/-
Sister Models from 17/6

SEND FOR FREE BOWMAN BOAT LEAFLET—
it tells you all about the 'Snipe' and its famous sister ships 'Seahawk,' 'Eagle' and 'Swallow.' It also illustrates and describes the new ultrafast Aeroboats that caused such a sensation when introduced a month or so ago. Clockwork models too. Write to-day for your copy of the free leaflet to Bowman models, Dept. M5, Dereham, Norfolk.

See the 'Snipe' at Halfords, Hobbies or any good shop.
And don't forget BOWMAN BOAT WEEK—July 27th to August 1st.

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Love Learning Typewriting *on this Junior*

Affords keen delight and valuable instruction. Fitted with **metal type** (not rubber) and bell-stop. Complete with black and red ribbon, this easily worked machine prints clearly 68 characters. Full alphabet (capitals and small letters), figures, stops. Paper 3½ ins. wide, any length. Strongly constructed and finished in black Japanned metal with attractive red metal base and cover. Size 9 ins. × 8 ins. × 5 ins. **Satisfaction guaranteed** or money refunded if returned within three days. *Makes a splendid birthday gift.*

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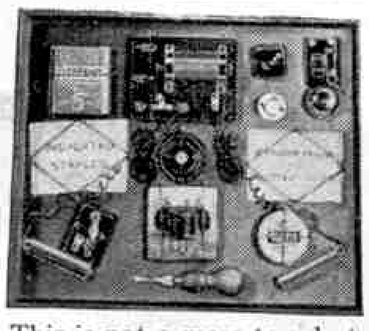

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Instructive—Harmless—Useful

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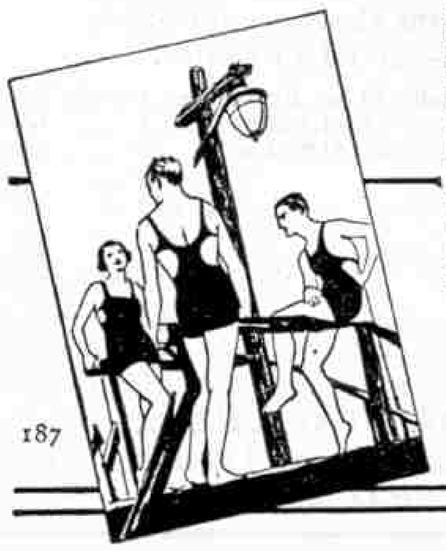

187

LONDON: 318, High Holborn. W.C.1; 78, Cheapside, E.C.2; 212, Putney Bridge Road, S.W.15. BIRMINGHAM: 69, New Street. LIVERPOOL: 22, Lord Street. MANCHESTER: 4, Oxford Street. LEEDS: 3, King Edward Street. BRISTOL: 42, High Street. BRIGHTON: 99, St. James's Street. SOUTHSEA: 94, Palmerston Road. GLASGOW: 21, Jamaica Street. EDINBURGH: 3, South Charlotte St. BELFAST: 15, Lombard St.

Write for a copy of photographic folder showing the full range of Spalding Suits as actually worn. Post free from any address above — Dept M.

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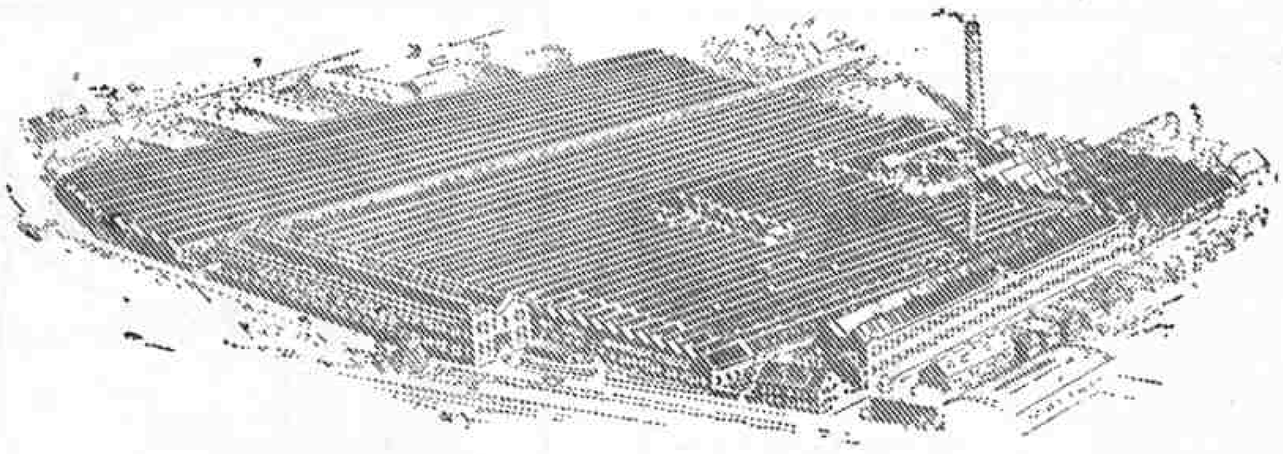

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Fitted with Brooks saddle and the best of everything. Specify Sturmey-Archer 3-speed gear, 20/– extra.

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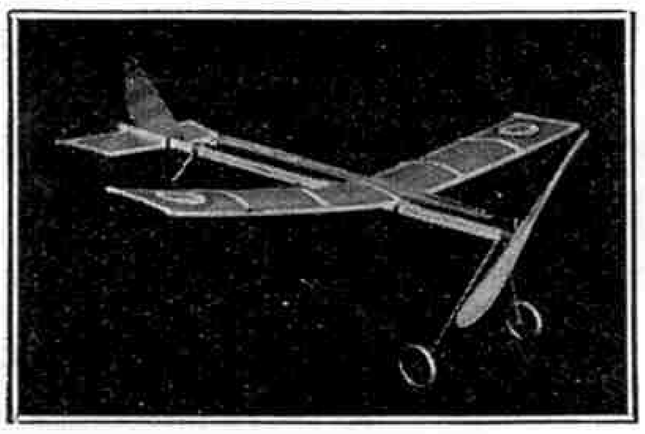

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LOOPS, STUNTS
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Telephone No.: Leigh-on-Sea **76277.** **ESSEX**

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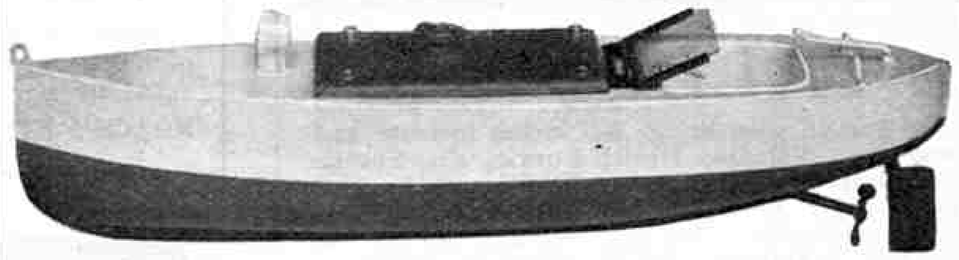

With hull and deck of steel, strong clockwork mechanism giving a long run with good speed. Fittings comprise Lever to start and stop, Adjustable Windscreen and Ventilator; finished in two-colour Cellulose. Packed in strong box with instructions.

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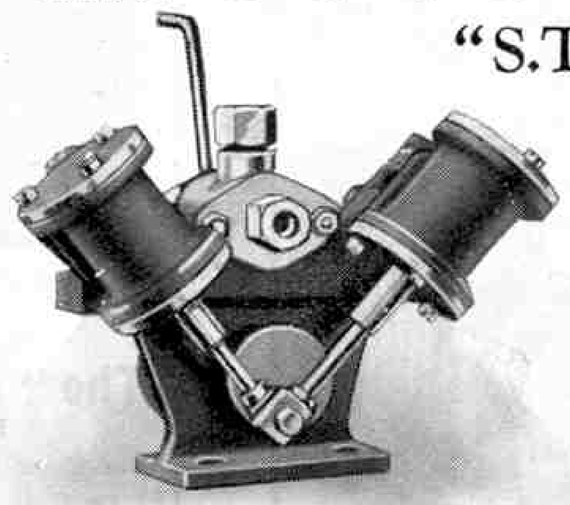

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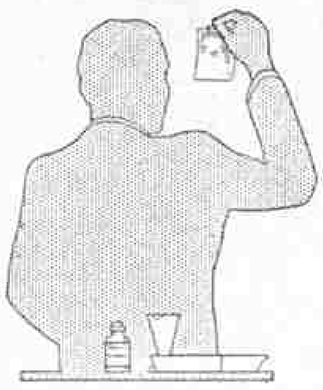

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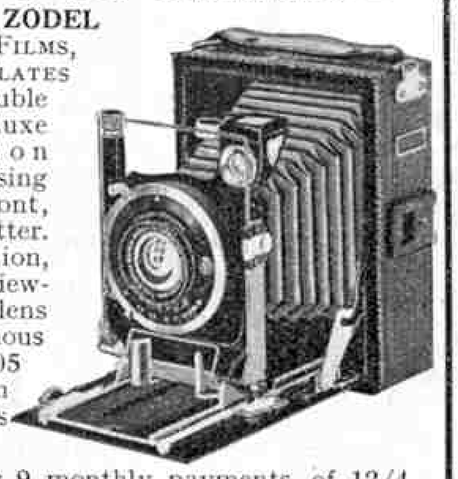

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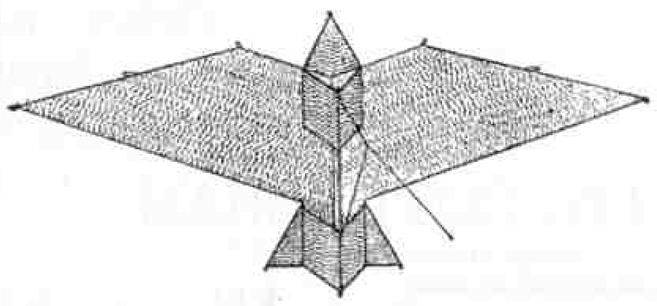

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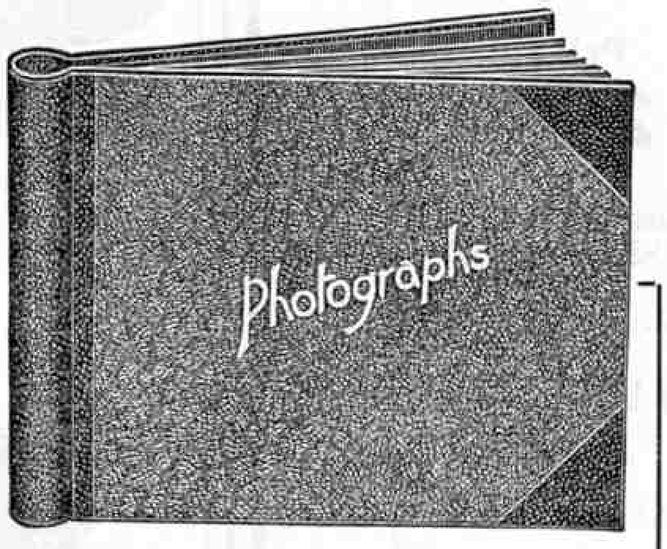

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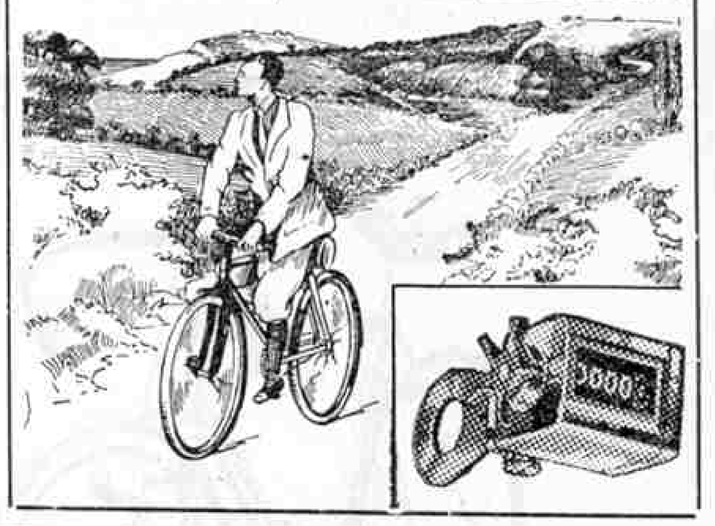

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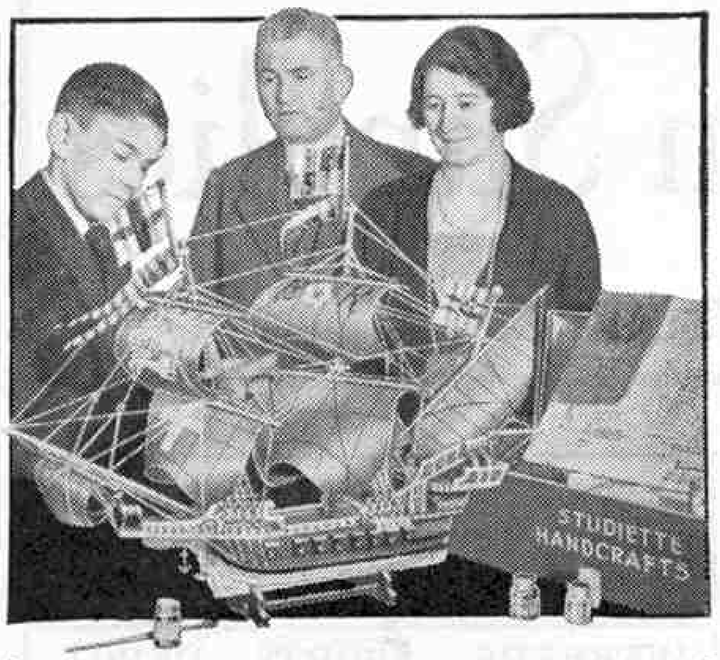

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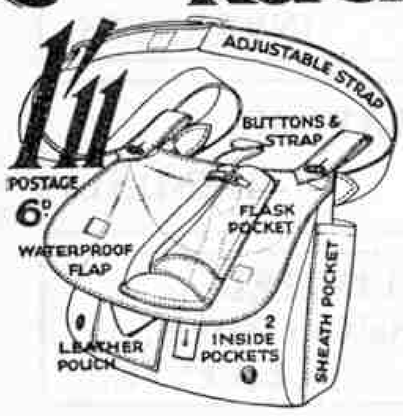

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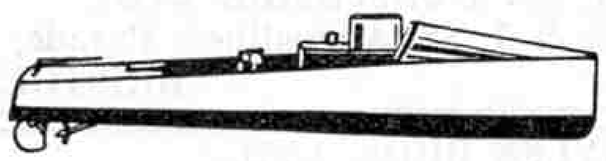

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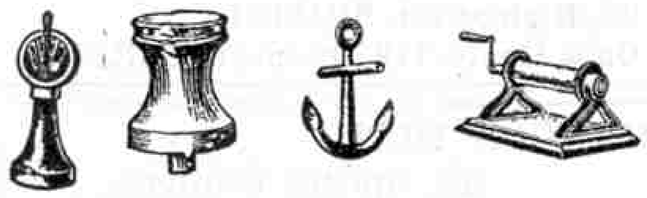

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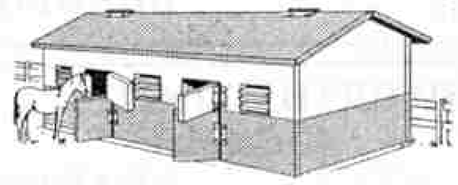

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Glorious First of June—(*Continued from page 535*)

disabled, exclusive of one sunk in the engagement. The "*Queen Charlotte*" had then lost her foretopmast, and the maintopmast fell over the side very soon after. The greater number of the other ships of the British fleet were at this time so much disabled, or widely separated, and, under such circumstances, with respect to those ships of the enemy in a state for action, and with which the firing was still continued, that two or three even of their dismantled ships, attempting to get away under a sprit-sail singly, or smaller sail raised on the stump of the foremast, could not be detained. Seven remained in our possession, one of which, however, sank before adequate assistance could be given to her crew, but many were saved."

The British losses in the battle were 222 killed and 700 wounded, while the French lost five or six times as many.

Although Howe defeated the French fleet, he failed in his other object of intercepting a large convoy of grain bound for France from America. This grain was of vital importance to France, and the safe arrival of the ships destroyed all hope of starving out the Revolution.

This was Howe's last battle. His health began to fail, and in 1797 he resigned his command. In the same year he was called upon to deal with the naval mutiny that broke out among the ships at Portsmouth and Spithead, and he brought the trouble to a conclusion, to the great relief of the country. The men had full confidence in his absolute fairness, and his personal popularity played a great part in the negotiations. It is probable that the worry and anxiety of this period shortened his life. His health became rapidly worse, and he died on 5th August 1799, in his 73rd year.

How to Get More Fun—(*Continued from page 581*)

Ambulance and tool vans, and other wagons, one of them carrying a spare bogie, are included; and various parts are also conveyed for securing the crane when lifting is being carried out.

Such a train may be made up on a Hornby railway in a very realistic manner by making use of such rolling stock as Breakdown Cranes and Luggage Vans. A Brake Van should of course be included, and for the match truck a Lumber Wagon or an ordinary open wagon will be quite suitable. When a mishap occurs and the services of the breakdown train are required, any convenient locomotive may be detailed to haul it on receipt of the summons at the depot.

A breakdown train that is on its way to the scene of an accident carries the same headlamp indication as an express, that is one lamp over each buffer of the locomotive. If the train is not going to clear the line it should be indicated in the same way as a stopping passenger train, that is with a single lamp below the chimney. Attention should be given to such points as this when running these trains on a Hornby layout.

Various details of actual practice may be imitated in miniature quite easily. If a Hornby locomotive is in for attention, such as periodical oiling, it looks more interesting if a small notice board lettered "Not to be moved" is placed in a prominent position.

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Sale. Racing Yachts from 8 in. to 24 in. decks. Prices 5/– to 30/–. Write for particulars.—C. D. Pengelley, Walderston, Jamaica.

Sale. Brownie and Ensign Camera; 400 "Magnets" and "Populars." Write for particulars.—Box 703.

Cigarette Cards. 1½d. Stamp for List.—M. Buckeridge, High Street, Calne, Wilts.

Sale. Meccano Magazines, Dec. 1925-Nov. 1926, Bound, slightly soiled. Dec. 1926-June 1927, Bound, slightly soiled. July-Dec. 1927, no covers. Jan. 1928-Dec. 1929, good condition. What Offers? Also Holiday Annual 1929, Hobby Annual 1930, and 300 Things a Bright Boy Can Do, 3/6 each. Also Holiday Annual 1925, 1/6. Also, almost new Magic Lantern, good Lenses, 10 slides, cost 22/–, any reasonable offer accepted. Also New E.M.C.E. automatic blank cartridge pistol, 6 chamber, for 7/6, cost 12/6. Bargain —R. Hollinrake, Ansdell, Three Elms Rd., Hereford.

Sale. New Pedometer. Cost 25/–. Offers?—Allinson, Tenterden Tower, Hendon, N.W.4.

Sale. "Meccano Magazines," May, March, July, Sept., Oct., 1929, all 1930 to May 1931. Offers?—Bowley, 41, Harborne Road, Birmingham.

For Sale. Parts for Mullard "1931 Orgola" receiver, also unused Lissen Pick-up and Tone-arm, latest model.—Ibbott, New Road, Chatteris.

80 Meccano Magazines, March 1924 to May 1931. Complete except 8 copies. All spotless, 22/– or nearest. "Miss America" 6/–.—Moll, Town Hall, Lowestoft.

Wanted. Stamp Catalogue, 1930 or 1929. Will pay 2/6.—Box 701.

For Sale. A Light Bicycle. In fine condition. Cost £5/10/–, for £3/–/–.—Particulars, Box 702.

Sale. Bowman Express Steam Loco and Tender, 4 Trucks, 32/6, as new, also 50-ft. Track, Turntable, Level Crossing, 5 Points, all new, 30/–.—Harman, 21, Adalia Crescent, Leigh-on-Sea, Essex.

"Meccano Magazines, Jan. 1928-Dec. 1929, and April-March, 1930.—Apply, R. W. Browell, c/o Mrs. Ward, Mount Pleasant, Diss, Norfolk.

5-Guinea BGL Chemical Cabinet, complete. Used once. Offers? Also 148 "Modern Boys," 50 "Thrillers," 13 "Union Jack's." Perfect condition. Offers?—A. R. Weaver, 51, Cambridge Road, Crosby, Liverpool.

Exchange. Conjuring Apparatus, Magic Books, value £10, for Hornby Engines, etc.—Draper, Heber Rd. School, E. Dulwich, S.E.22.

Wanted. Exchange of European Stamps.—Wilh. Jahre, c/o Herman Lindell, Helsingfors, Finland.

Your Railway Photographs, neatly framed, for a very low price. Bowman Steam Engine, exchange for any kind of Coupons.—L. White, 104, Ship, Chard.

Sale. "Modern Boys" 1-139 (96, 114 missing). Offers? —A. Monkman, 31, Dent St., West Hartlepool.

Sale. Hobbies Fretwork Machine. Cost 50/–. Good condition. 12 Fretwork Designs. Cost 7/6. 60 "Modern Boys." Offers? —Stewart, Cannings-town, Bailieborough, Cavan.

Sale. Tinplate Track and Rolling Stock. Cheap.—Fewster, 164, Palmerston Road, N.22.

B.O.P., Punch, Art, Philately Literature, large library, clean bargains. Lists.—Thos. Thornburgh, 122, Spring Gardens, Edinburgh.

Sale. "Meccano Magazines," No. 1 to Dec. 1930, bound in 9 handsome volumes, £3/3/–.—Tuck, 33, Meadowside, Lancaster.

For Sale. 1 valve Wireless Set, including coils and valve, 21/–. 1 valve Amplifier to match, including valve, 21/–. B.T.H. Loud Speaker to work off above, 25/–, cost £3. Above three items together, 63/–. Marconiphone Headphones, 9/–. L.D. Headphones, 3/6. Wireless Annual, 2/6. Hulton's Adventure Stories, 2/6. Hobby Annual, 1928, 4/–. Hobby Annual, 1929, 4/–. Simplex Typewriter, Model H, 10/–. Model Howitzer Tractor Gun, with adjustable elevation and breech-loading (no shells), 5/–. Brand new Hand Drill (capacity 0–¼ in.), 5/–. Accordion, 10/–.—Leslie Harris, 109, North Road, Belfast.

Wanted. Set of 16 Cards "Marvels of Future" presented with "Gem" 1929.—Box 704.

Sale. 30 "Meccano Magazines," 128 "Modern Boys," 50 "This and Thats," 32 "Skippers." Almost perfect. Cost 50/–. Take 24/–. Would separate.—Ed. Ryan, Curraghpoor, Tipperary, I.F.S.

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TOULMIN, 21, SOHO SQ., LONDON, W.1.

FOR THAT BIRTHDAY!

Model Contest Results—(*Continued from page 572*)

Wheel, and is mounted on the shaft of a Crank Handle so that its contents may be emptied.

J. Lewis' model, with which he secured Second Prize in this Section, is a travelling and swivelling crane. The jib, consisting of 5½" Strips, is attached to a framework of Strips and Double Angle Strips, to which a Bush Wheel is secured. A short Rod gripped in the boss of the Wheel forms a pivot for the superstructure, and passes through a hole in a 5½" × 2½" Flanged Plate mounted on Wheels. Flat Trunnions secured near the base of the jib form journals for a Crank Handle, which operates the hoisting mechanism.

A crane formed the subject also of E. Strang's entry. This model is of a more simple nature than that submitted by Lewis, however, and incorporates hoisting and travelling movements only.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—

OLD SWAN, LIVERPOOL, ENGLAND.

Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/5 per copy (postage extra), and the subscription rates 9/6 for six months and 19/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

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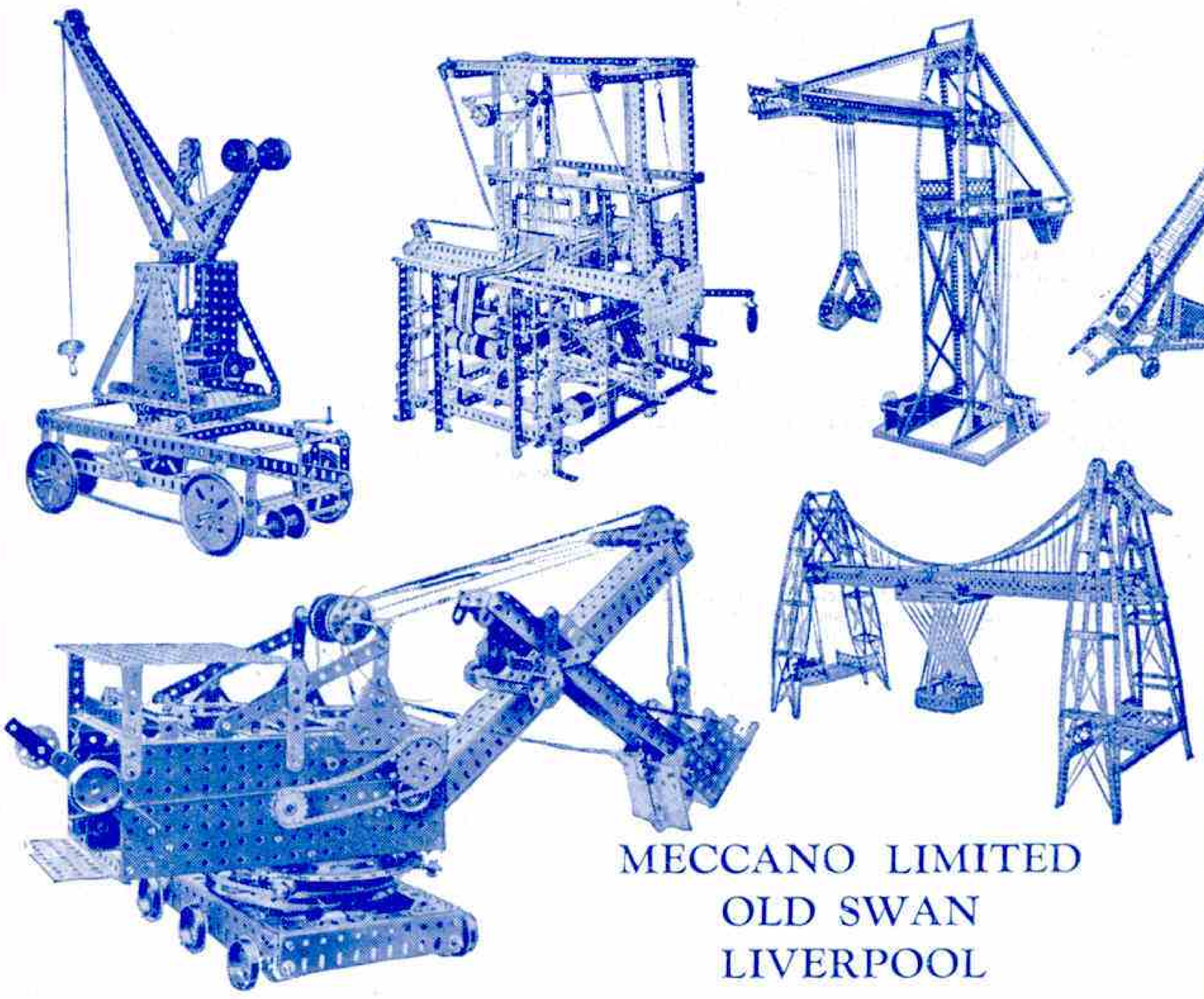

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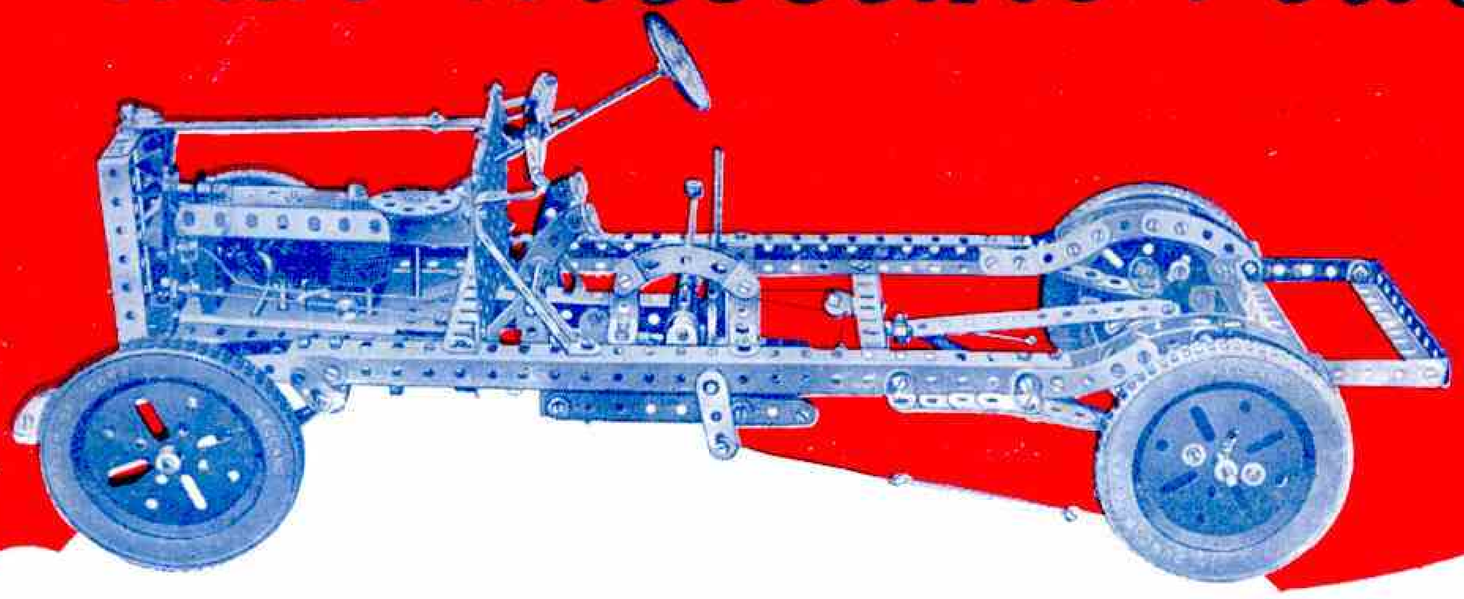
						Price
No.	00a	converts	No. 00	into	No. 0	1/6
„	0a	„	„ 0	„	„ 1	5/6
„	1a	„	„ 1	„	„ 2	7/–
„	2a	„	„ 2	„	„ 3	12/6
„	3a	„	„ 3	„	„ 4	26/–
„	4a	„	„ 4	„	„ 5	17/6
„	5a*	„	„ 5	„	„ 6	55/–
„	5a†	„	„ 5	„	„ 6†	97/6
„	6a†	„	„ 6	„	„ 7	235/–

* Carton. † Enamelled cabinet.

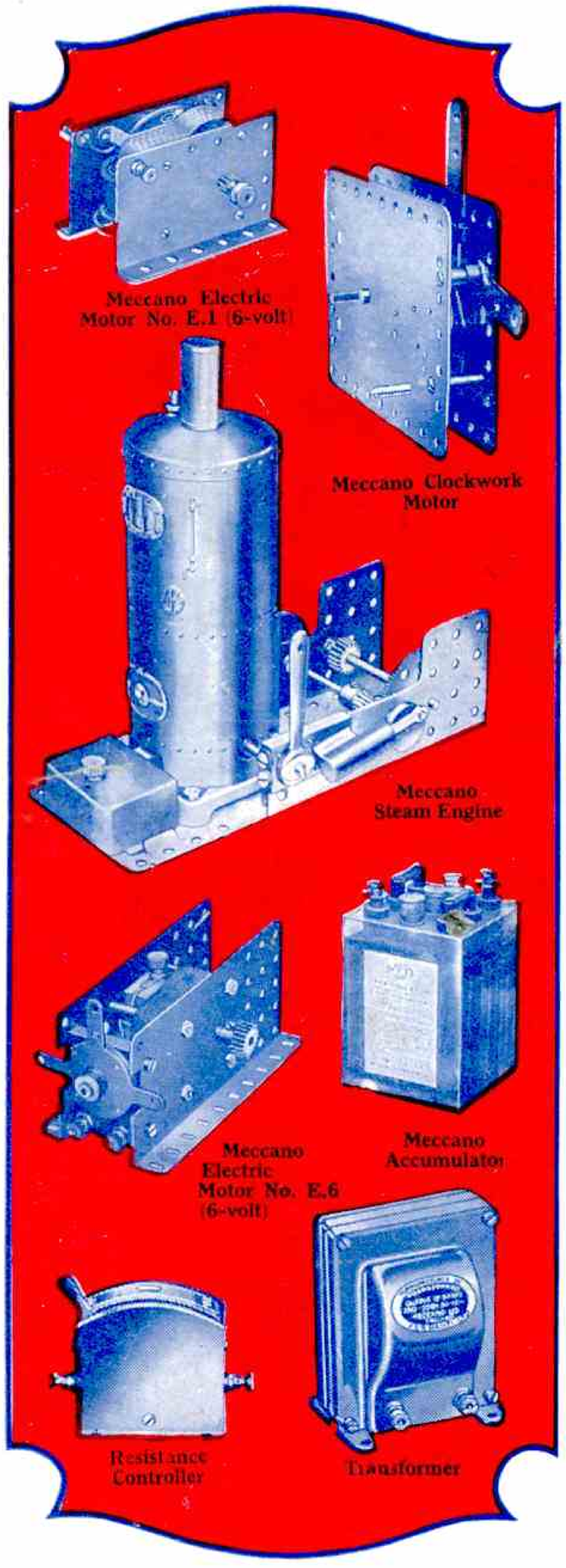
I run my models with Meccano Power



If you want to obtain the fullest possible enjoyment from the Meccano hobby you should operate your models with a Meccano Motor or Steam Engine. You push over the control lever of the motor or engine and immediately your Crane, Motor Car, Ship Coaler or Windmill commences to work in exactly the same manner as its "big brother" in real life. Could anything be more exciting?

The Meccano Motors and Steam Engine are strongly made and the utmost care is taken in their manufacture to ensure that they will give satisfaction. The side plates and bases are pierced with the standard Meccano equidistant holes, which enables a motor or engine to be built into any Meccano model in the exact position required.

Particulars and prices of the Steam Engine, Motors and Accessories are given below.



Meccano Clockwork Motor

This splendid Motor, which is specially designed for operating Meccano models, is a compact self-contained power unit.

An efficient governor controls the spring that is fitted on the motor and ensures a long steady run at each winding. Brake and reverse levers enable the motor to be stopped, started and reversed as required. Supplied complete with winding key and full instructions. Price **7/6**

Meccano Steam Engine

This is a particularly powerful steam unit designed for driving Meccano models. On actual test it has lifted over 56 lbs. A single cylinder of the oscillating type is employed, steam being admitted to it through a special reversing block. Operation of the reversing lever enables the crankshaft, which is fitted with a special compensating flywheel to run in either direction.

The spirit container for the lamp is placed well outside the boiler-casing, eliminating all risks of the spirit becoming heated. The boiler is fitted with an efficient spring safety valve of heavy gauge brass and there is no danger whatever of the boiler exploding. Price **25/-**

Meccano Electric Motor No. E.1 (6-volt)

This highly efficient Electric Motor (non-reversing) gives excellent service. A 6-volt Accumulator will operate it, but it may also be driven from the main (alternating current only) through the Transformer described in the next column. Price **7/6**

Meccano Electric Motor No. E.6 (6-volt)

This 6-volt Motor is specially designed to build into Meccano models. It may be run from a 6-volt accumulator or, by employing the Transformer described below, from the main. It is fitted with reversing motion and provided with stopping and starting controls. The gearing is interchangeable. Price **15/6**

IMPORTANT.—Meccano 6-volt Motors will not run satisfactorily from dry cells.

Accumulator (6-volt, 20-amps)

The Meccano Accumulator is of substantial construction and is specially recommended for running the Meccano 6-volt Electric Motors. Price **28/6**

Transformer

By means of this Transformer the Meccano 6-volt Electric Motors may be driven from the house supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at all standard frequencies. The supply voltage and frequency must be specified when ordering. Complete with length of flex and adapter for connection to an ordinary lamp socket. Price **30/-**

Resistance Controller

By employing this variable resistance the speed of the Meccano 6-volt Electric Motors may be regulated as desired. The controller is connected in series with the motor and accumulator, or with the motor and transformer if a transformer is used as the source of power. It will not regulate the speed of a high-voltage motor connected to the main. Price **4/6**

MECCANO LTD.

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